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JPRS-UST-86-017

28 JULY 1986

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# USSR Report

SCIENCE AND TECHNOLOGY POLICY

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28 JULY 1986

# USSR REPORT

## SCIENCE AND TECHNOLOGY POLICY

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## FACILITIES AND MANPOWER

### MEKHANOBR INTERSECTORIAL SCIENTIFIC AND TECHNICAL COMPLEX

Leningrad LENINGRADSKAYA PRAVDA in Russian 14 Feb 86 p 2

[Interview with Corresponding Member of the USSR Academy of Sciences Vladimir Ivanovich Revnivitsev, manager of the Mekhanobr [mechanical processing] Intersectorial Scientific and Technical Complex and director of the All-Union Scientific Research and Design Institute of the Mechanical Processing of Minerals, by V. Chichin under the rubric: "Science: From the Design to the Object": "The Harvest From the 'No Man's Land'"; place, date, and occasion not given; first three paragraphs are LENINGRADSKAYA PRAVDA introduction]

[Text] "Light Guide," "Robot," "Laser Technology," "Personal Computer," "Biogen".... The distinctive marks of our age are easily guessed behind these words. However, we have before us not simply a list of modern technical terms, but the names of already legitimized large interdepartmental complexes. They are called upon to ensure a sharp acceleration in the main directions of scientific and technical progress.

The question is posed in precisely that way in the decree of the CPSU Central Committee and the USSR Council of Ministers on the establishment of interdepartmental scientific and technical complexes (MNTK) and measures on the support of their activity. Since the beginning of this year 16 interdepartmental complexes have been operating in our country. A Leningrad organization--the All-Union Scientific Research and Design Institute of the Mechanical Processing of Minerals--is in charge of one of them, the Mekhanobr Interdepartmental Scientific and Technical Complex.

We asked Corresponding Member of the USSR Academy of Sciences V.I. Revnivitsev, its manager and director of the institute, to tell about the tasks of the new complex.

[Question] Vladimir Ivanovich, to what is the appearance of the new form of the interaction of science and production attributable?

[Answer] Direct your attention to the fact that the intersectorial nature of the complexes is emphasized already in the name. What means have been used in combating the notorious departmental barriers. Remember how many hopes were placed in comprehensive goal programs, but their implementation is also frequently being hindered precisely at the meeting point of sectors. It is

especially difficult for an innovation to break through here. But the greatest reserves also lie precisely in the surmounting of sectorial barriers. This is the same "no man's land," which for a long time remained unused. The interdepartmental scientific and technical complexes will be vitally interested in the use of the extensive possibilities of the "no man's land."

And still it is not this argument that I would call decisive. The strategic need for the establishment of interdepartmental scientific and technical complexes follows from the draft of the Basic Directions of USSR Economic and Social Development. In it a fundamental task is posed--to develop new organizational forms of the integration of science, technology, and production, which make it possible to cover quickly and efficiently the path from the development of an idea to its extensive use. It is possible to achieve this only in case of a unified scientific and technical policy in the solution of important national economic problems. Moreover, they will have to be solved without the attraction of additional resources, exclusively by means of intensification.

[Question] Apparently, there should be significant reasons for the themes of your institute to have also been included among such especially important problems. In other words, what was the reason for the appearance of the Mekhanobr Interdepartmental Scientific and Technical Complex?

[Answer] I will immediately specify that far from all our themes will be elaborated within the complex, but only the most promising ones and only on the condition of their further use in various spheres of the economy. The existence of such ideas in many ways governs the appointment of the institute as the main one for the complex. As a whole the principles of the selection of the main organization in all interdepartmental scientific and technical complexes are common--the importance of the problems of the collective in the intersectorial context and the degree of readiness for the solution of these problems.

As to the reasons for the appearance of the Mekhanobr Interdepartmental Scientific and Technical Complex, they are very serious. After all, more than 5 percent of all the electric power generated in the country is used for the processing of mineral raw materials. And how many more sectors need advanced technologies of the crushing and grinding of materials: construction and the processing of industrial waste products, the pulp and paper and the food industries, the production of medicinal compounds, and so on.

For the present both in our country and abroad these technologies are some of the most energy-consuming, metal-consuming, and labor intensive ones, in short, expensive and unproductive ones. The point is that the principles of the organization of the process of crushing are archaic, for many decades equipment has been developed only along the line of improvement. Therefore, our task is to develop such equipment which leads to revolutionary changes in the technology of the crushing and grinding of any hard materials.

[Question] What is preventing scientists and designers from introducing fundamentally new equipment?

[Answer] What the complexes are aimed against is isolation. Considerable forces and assets are as if being allocated--more than 50 scientific research institutes and design bureaus and tens of enterprises of the country are dealing with this problem. But no one is coordinating their efforts, there are many parallel operations, the proper basic research does not exist. And, what is the most regrettable thing, when it comes to the organization of the output of new equipment, everything is again held up by narrow departmental barriers. Machine builders, for example, are much less interested in new crushers than the using sectors are. Hence, too, the result.

[Question] How will these barriers be surmounted on the scale of the Mekhanobr Interdepartmental Scientific and Technical Complex?

[Answer] Each complex is established only in accordance with a decision of the USSR Council of Ministers. It approves the list of organizations and enterprises of various ministries and departments, which take part in the activity of the complex. Hence the main demand on the work of all the units--obligatoriness. More than 10 sectorial scientific research institutes, approximately the same number of academic institutes and higher educational institutions, a number of departmental organizations, and, finally, industrial enterprises, among which are such giants as the Uralmash, Novokramatorskiy mashinostroitelnyy zavod, and other production associations, belong to our sphere. The managers and specialists of these collectives belong to the council of the complex, which on the basis of the suggestions of the main organization specifies the plans of work for the year and 5-year period.

[Question] Go into a little more detail about the mechanism of interaction.

[Answer] After our plan is approved in the State Committee for Science and Technology, it should be approved in the USSR Academy of Sciences and the USSR State Planning Committee. This is fundamentally important: ideas undergo expert analysis, and then receive guarantees of rapid implementation. In what way? At the first stage several test runs of new equipment are produced by individual enterprises of the corresponding sectors. If the equipment passes the test, the State Planning Committee includes it in the plans of the ministries without fail.

We have been given the right to establish engineering and regional scientific and technical centers for the preparation and introduction of new equipment. We can also enlist in our work various enterprises and institutions, which legally do not belong to the complex.

[Question] Vladimir Ivanovich, do such rights probably imply increased responsibility as well?

[Answer] To say that our accountability will increase means to say hardly anything. It will be radically different. Now a task can be considered accomplished only when fundamentally new equipment appears in production prototypes, when all the auxiliary systems are ready, when standard designs of new works exist. But this is also not everything. Within the complex, if required, it will be necessary to organize the retraining of personnel for the new equipment, and with respect to the most central problems (in interaction

with our higher educational institutions) also the training of specialists in the new directions of the improvement of equipment and technology.

[Question] Is the collective of the institute ready for work under the new conditions?

[Answer] The question is a difficult one. From the standpoint of the scientific reserve and design resources we have headed the interdepartmental scientific and technical complex with adequate reason. I will say, for example, that we have already now models of fundamentally new machines which in their technical level are higher than world analogues.

Another matter is the psychological readiness of people. As the recent meeting of the party and economic aktiv, which was devoted to the changeover to the new conditions of work, showed, far from everyone realized the level of the present demands. Many people do not want to resign themselves to the thought that the time of the constant improvement of models of equipment, which have existed for a long time, has ended. New generations of machines are needed. It is necessary to seek such forms of the organization of labor, in case of which scientists, designers, and planners would change over in essence to work on a single order. Such is the opinion of not only the administration and the party committee, but also the majority of specialists of the institute. Precisely this circumstance also puts one in an optimistic frame of mind.

[Question] When will it be possible to speak about specific results of the reorganization?

[Answer] We have a precise program of actions for the five-year plan and to 2000. Several new generations of machines precisely for intersectorial use will appear already during the current 5-year period. I have already spoken about the industrial tests of individual models of such equipment. Here are just a few results. The use, for example, of an inertial cone crusher when processing paper pulp increases by two- to fourfold the rupture strength of paper and by fifty- to a hundredfold the breaking strength and decreases to one-third to one-half the consumption of electric power in this operation.

We will direct the attention of both our collective and the partners in the interdepartmental scientific and technical complex to the development of such machines. We simply do not have the right to less. By the end of the five-year plan we are obliged to obtain an economic impact in the amount of about 100 million rubles, while by 2000 this indicator should increase to 2 billion rubles.

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CSO: 1814/161

## FACILITIES AND MANPOWER

### UKRAINIAN ENGINEERING CENTERS HELP TO INTRODUCE DEVELOPMENTS

Moscow LITERATURNAYA GAZETA in Russian 15 Jan 86 p 11

[Article by LITERATURNAYA GAZETA correspondent for the Ukraine S. Kiselev: "The Engineer Is the Main Figure! Notes on the New Subdivision in the System of the Ukrainian SSR Academy of Sciences"]

[Text] "We are relying on the Institute imeni Paton and the Institute of Superhard Materials," V.A. Izvekov, director of the Bolshevik Production Association, says to me. "With their aid we will supply robots for welding and will introduce hard alloy tools, in order when machining metal to obtain the 12th, 13th surface finish classes--the highest. And if we do not do this, we will upset the plan...."

Vitaliy Alekseyevich is ready to welcome any innovations within the framework of scientific and technical progress, but...all the same they make the director responsible first of all for the plan. Is the risk not too great, when the future of the plant first of all depends on the efforts of scientists?

"The risk has more than once justified itself," Izvekov replies. "Such was the case with electroslag casting--a development of the workers of the Institute of Electric Welding imeni Ye.O. Paton. The engineering centers will show us, or else make a finished machine, as well as train our specialists."

The engineering centers are a chain: the scientific department--the design and technological bureau--pilot production. From 50 to 250 people work at each engineering center. There are a scientific supervisor and a director here.

Eight such subdivisions already exist in the system of the Ukrainian Academy of Sciences. There are six at the Institute of Electric Welding imeni Ye.O. Paton and one each at the Institute of Cybernetics imeni V.M. Glushkov and the Institute of Superhard Materials.

Life is already giving many arguments in favor of such centers. Here is one of the examples. The technology of applying wear-resistant coatings to the parts of machines during the repair of equipment, which was developed by an institute, was introduced at one mining and metallurgical combine.



The metallurgists did not want very much to reorganize repair work. But the institute brought pressure to bear. And soon they were convinced at the combine: new parts wear out three- to fourfold more rapidly than restored old ones. Then they began to break down into parts the bulldozers, dump trucks, tractors..., which are arriving from machine building plants. In the machine shops they coated the parts with wear-resistant materials, and then reassembled the machines. But in order for the institute to convince the machine building plants, which belong to different departments, to harden themselves the parts of the equipment being produced, a field meeting of the USSR Academy of Sciences with the participation of 16 deputy ministers had to be organized.

Now the engineering centers have assumed the task of disseminating and duplicating scientific developments for their large-scale introduction in industry. The Institute of Electric Welding imeni Ye.O. Paton always tried to see to it that its scientific achievements would be actively used at the works.

Imagine: the scientific research institute struggled for several years with the development, finally it was approved and turned over to industry. The economic impact from introduction is measured by figures with many zeros. But only one plant is adopting it, while hundreds could use the innovation. Is this a state approach to the matter? According to the data of the USSR State Committee for Science and Technology, 80 percent of the new developments are used at one enterprise of the country. Another 20 percent are introduced at three or four. And only 0.6 percent are introduced at five and more. But many are not implemented at all, their advancement is dragged out, and they become obsolete. At the same time, as Academician B.Ye. Paton noted, the results of domestic scientific discoveries, finding themselves abroad, are used there very promptly. It is necessary at times to purchase abroad materials and equipment, which have been produced in accordance with our licenses.

The engineering centers are called upon to change this situation.

The Ukrainian Academy of Sciences and the Kiev City Party Committee held the seminar "Engineering Centers Are an Effective Form of the Contact of Science and Production." Its participants filled out a short questionnaire. One of the questions was the following: "What problems would you want to solve with the assistance of the engineering centers?" The responses proved to be unexpected. It turned out that the enterprises of the city with the assistance of the engineering centers want to eliminate nearly all the difficulties with which they are faced.

"Yes, it is easy to discredit the idea," A.V. Palagin, manager of the Engineering Center of Microelectronics and deputy director of the Institute of Cybernetics imeni V.M. Glushkov, says. "The engineering centers are not a personal services bureau, but a subdivision of rapid response, which deals with large-scale introduction. The scientific institution needs a powerful production base for producing prototypes. And the most important thing is: an official legal status is required."

Everyone--from the president of the Ukrainian SSR Academy of Sciences to rank and file designers and process engineers--is speaking about this.

We made the acquaintance of Georgiy Mayboroda, a worker of the Engineering Center of Pressure Welding of the Institute imeni Ye.O. Paton, at the field tests. The State Commission had to evaluate the K-805 machine for the butt resistance welding of pipes, which was developed at the institute and did not have analogues in world practice.

The machine, which weighs 10 tons, was mounted on a jig. Mayboroda stood next to it and by means of a remote control panel supervised the welding. The butt jointing of the pipes took only 3 minutes.

"How was it earlier?" he said. "The staff members of the scientific departments gave us theoretical ideas, we, the designers and process engineers, developed them, but the next day, let us face it, forgot about this. What will happen further with the development and how the pilot works will execute it in metal, was of little interest to us. But since the time that the engineering center was established, the attitude of the majority of my colleagues to the work has changed greatly. It became more responsible, more moral, perhaps. The very name of the center emphasizes the role which has been assigned to us engineers. He is now the main figure! Moreover, we are now seeing the end result of our labor, that is why I am at the testing ground."

"And does the wage depend on the end result?"

"Unfortunately, not to the degree that one would wish. For the present we are working mainly on enthusiasm. They are promising us in the future bonuses for work quality and skills. But all of this will happen when the engineering centers receive an official status. So we are waiting."

V.G. Krivenko, director of the center, with whom I met the next day, is also waiting for this.

"All such subdivisions are called engineering centers only at our institutes," Valeriy Georgiyevich noted. "We are not on the official staff list of the USSR Academy of Sciences. The engineering centers need the special-purpose allocation of assets. Otherwise we will not be able to properly introduce promptly in the national economy scientific and technical developments."

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## FACILITIES AND MANPOWER

### ALL-UNION INSTITUTE OF LOW MOLECULAR OLEFINS

Baku BAKINSKIY RABOCHIY in Russian 28 Jan 86 p 3

[Article by Academician of the Azerbaijan SSR Academy of Sciences M. Dalin, director of the All-Union Scientific Research Institute for the Synthesis and Processing of Low Molecular Olefins and its pilot plant, twice winner of the USSR State Prize, winner of the Prize of the USSR Council of Ministers, and honored figure of science, under the rubric "Science for Production": "The Prerequisites for Growth"]

[Text] In the precongress party documents particular attention is directed to the intensification of the integration of science and production and the increase of the responsibility of scientific organizations for the level of research and for the development and introduction of new equipment and advanced technology, which conforms to world standards. The tasks of the collective of the VNIIOlefina--the All-Union Scientific Research Institute for the Synthesis and Processing of Low Molecular Olefins--and its pilot plant are also determined by this. But our leading goal is to promote in every possible way the development of petrochemistry. And first of all in our republic. In the draft of the Basic Directions of the Economic and Social Development of the Country it is recorded to ensure in the Azerbaijan SSR during the 12th Five-Year Plan the further growth of the petrochemical industry.

The collective of the institute is celebrating these days its 50th anniversary. And we say with full right that here abundant and glorious traditions exist and are being developed. The history of the All-Union Scientific Research Institute for the Synthesis and Processing of Low Molecular Olefins began during the period when large synthetic rubber plants were being built in the world. Ethyl alcohol, which is obtained from a food product, was used at them as the raw feedstock. A group of republic engineers--staff members of the Azerbaijan Scientific Research Petroleum Institute imeni V. Kuybyshev--proposed a fundamentally new technology. It consisted in the fact that ethyl alcohol should be produced synthetically from the gases of petroleum refining. For the technical implementation of this idea in 1936 a pilot plant of the AzSK was established, the All-Union Scientific Research Institute for the Synthesis and Processing of Low Molecular Olefins also traces its history from it. The collective of this enterprise was able in a short time to solve the basic problems of the technology of the processes of the pyrolysis of petroleum fractions and the



separation of the gases of pyrolysis with the obtaining of ethylene and propylene, as well as the synthesis of ethyl alcohol.

Just as the workers of industry of the country, the collective of the plant during the years of the Great Patriotic War devoted all its efforts to the filling of the orders of the front. Processes of the synthesis of alkylbenzene for the obtaining of high octane components of gasoline and acetone were developed.

The plant organized the production of products of "small-scale" chemistry--components of incendiary fuel, chemicals for smoke generators, and others. When the years of peace came, the collective of the enterprise launched anew the development of large-tonnage chemical technologies based on petroleum feedstock. In many ways the firstling of domestic large-tonnage petrochemistry--the Sumgait Synthetic Rubber Plant--was established precisely on this basis. The first works in our country of synthetic ethyl alcohol and ethylbenzene--raw materials for many types of plastics and rubber--were put into operation here. Subsequently--in the 1950's and 1960's--the developments of the pilot plant of the AzSK for obtaining ethyl and isopropyl alcohol, ethylbenzene, and propylbenzene were implemented at practically all the petrochemical complexes being put into operation in the country--in Ufa, Novokuybyshevsk, Groznyy, Orsk, and other cities. In 1962 the plant was reorganized into the All-Union Scientific Research Institute for the Synthesis and Processing of Low Molecular Olefins, which from the very start also had a pilot enterprise.

The gained scientific and technical potential began to yield fruits in the 1970's. The fact that during the years of the 10th and 11th Five-Year Plans 40 developments were introduced in industry and their total annual economic impact came to about 30 million rubles, attests to the significance of the contribution of the collective of the All-Union Scientific Research Institute for the Synthesis and Processing of Low Molecular Olefins.

During the past five-year plan the results of research in the area of "small-scale" chemistry were introduced. Among them are the synthesis of a monomer for unique thermostable plastics at the Okhtinskiy Plastpolimer Scientific Production Association (Leningrad) and advanced technologies at the Yerevan Plant of Chemical Reagents. A composite for the machining of parts, which was proposed by our specialists, has shown itself to advantage at many machine building enterprises and in the automotive industry, particular at the AvtoVAZ Association and the Kama Motor Vehicle Works.

Thus, a promising direction of research of the institute has become firmly established. It is safe to say that we have the prerequisites for the launching of work in that area, the importance of which is emphasized in the draft of the Basic Directions of the Economic and Social Development of the Country. In this party document it is outlined to ensure the rapid growth of the production of advanced construction plastics and other polymer materials, to increase the output and enlarge the range of small-tonnage chemical products, first of all of fine organic synthesis.

It is worth dwelling on the work of the institute, which has just been completed or is being continued. A fundamentally new technology of the combined production of two most valuable petrochemical products--propylene and styrene oxides--has been introduced at the Nizhnekamskneftekhim Association. It is important that it is ecologically clean. Previously an American firm had a monopoly on such technology, now there is domestic production, and it is especially valuable that the possibility of expanding the use in the national economy of our country of polyurethanes--polymer materials which have a practically unlimited area of application--has been obtained.

A new direction of industrial petrochemical synthesis--the production of higher olefins on the basis of ethylene and propylene--was formed recently at the All-Union Scientific Research Institute for the Synthesis and Processing of Low Molecular Olefins. The technology here to some extent is reminiscent of blocks, which then become the source material for complex compounds--surfactants, synthetic lubricating oils, oil additives, polymers with improved physical chemical characteristics. The use of such a principle simplifies appreciably the task of synthesizing compounds with preset properties. Now, when the reader is acquainting himself with this article, at the Nizhnekamskneftekhim Association start-up and adjustment work is under way at the new plant, at which the technology developed at our institute of "block assembly," if it is possible to call it that, will operate.

In the republic the All-Union Scientific Research Institute for the Synthesis and Processing of Low Molecular Olefins is the pioneer of research in the area of polymer chemistry. It is being successfully continued. At present specialists of the institute have developed and checked at pilot plants efficient processes of the synthesis of low-density linear polyethylene and ethylene-propylene rubbers. These processes have been completely readied for industrial introduction. Much work is being performed on the modification of polymers by effective methods, and as a result entirely new properties and very high heat and wear resistance is being given to the chemical material, as well as work on new composite materials.

While conducting research on the development of new technologies and products, the scientists and specialists of the All-Union Scientific Research Institute for the Synthesis and Processing of Low Molecular Olefins are devoting serious attention to the problems of the intensification of operating works and their retooling and renovation. The tests of a new catalyst at the plant of synthetic rubber yielded positive results, the catalyst for the additives plant was improved, it is a matter of Sumgait enterprises. Proposals on the improvement of the arrangement of one of the leading works are being elaborated for the former of them.

Our technological processes are being implemented at petrochemical enterprises throughout the country. But their most intensive introduction during the 12th Five-Year Plan will take place precisely in Sumgait. Our scientists and specialists are linking many hopes with the start-up at the synthetic rubber plant of the EP-300 complex and the organization on the basis of its output of large-tonnage works of benzene, ethylbenzene, isopropyl alcohol, propylene oxide, and others. With respect to these processes the institute has issued the data for designing. We realize that our contribution to the development

of the the petrochemical industry of the republic for the present is less than should have been expected from the All-Union Scientific Research Institute for the Synthesis and Processing of Low Molecular Olefins. The collective resolutely intends to change such a situation. And now the institute is offering, with allowance made for the prospects, new processes of the synthesis of polymer materials for industry of Sumgait.

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CSO: 1814/160

## FACILITIES AND MANPOWER

### PROBLEMS FACING YEREVAN DESIGN BUREAU OF AUTOMATIC EQUIPMENT

Yerevan KOMMUNIST in Russian 10 Jan 86 p 2

[Article by A. Abramyan, chief of the Department of Scientific Themes of the Yerevan Experimental Design Bureau of Automatic Equipment of the Khimavtomatika Scientific Production Association: "So the Designer Doesn't Re-Invent the Nut. What Is Hindering the Developers of New Equipment"; capitalized passages published in boldface]

[Text] HOW IS ONE TO QUICKLY TEACH A PERSON TO CONTROL THE COMPLEX TECHNOLOGICAL PROCESSES OF THE PRODUCTION OF CHEMICAL PRODUCTS? HOW IS ONE TO ELIMINATE THE ERRORS, WHICH INFLUENCE THE QUALITY AND QUANTITY OF A PRODUCT AND CAN CAUSE OTHER UNDESIRABLE CONSEQUENCES?

Our experimental design bureau of the Khimavtomatika Scientific Production Association is working on the solution of these problems. We are developing and introducing special simulators--software and hardware complexes for the scientifically sound training of a highly skilled regular labor force--the controllers of chemical technology processes and works. This is the main direction. Moreover, in the thematic plan there are assignments on the development of means of analytical testing based on radio isotope methods of analysis. In the area of simulator building our organization is the main one in the sector.

In a relatively short time our first five developments--unique training systems--were introduced at sectorial training centers and classrooms of enterprises, at which hundreds of controllers underwent training.

Everything is in order. The thematic plans are being fulfilled, we are working not in vain, there is a good evaluation of labor, it is possible to continue the activity in the same spirit.

But the times are changing, and today in the collective of the experimental design bureau they are dissatisfied with the evaluation of their labor. There is no real stimulation, introduction often takes place without leaving a trace. The material stimulation fund decreased from 35,600 rubles in 1981 to 1,300 rubles in 1985.

What is the matter?

The procedure of forming and distributing the economic stimulation fund (FES) is based on its formation subject to the economic impact which has been obtained from the use in the national economy of scientific and technical developments and new equipment. The prevailing system had a definite influence on the increase of the efficiency and the shortening of the time of research and development, but in everyday practice it turned out that this system is not without shortcomings.

Thus, the base of the formation of the economic stimulation fund is the actual economic impact. Before the start and in the process of development the economic stimulation fund is calculated subject to the anticipated impact which has been agreed upon by the client. We, the developers, know that the anticipated economic impact differs from the actual economic impact, the clients do not bear responsibility for the conformity of the actual impact to the anticipated impact. As a result there are litigation and the refusal of the client to agree on the new result of the obtained impact.

The adopted procedure of forming the incentive fund is good for design organizations, which develop new equipment which is produced in large series, and is in no way suitable for us, who are developing the latest complex systems and instruments in a single copy or in a small series--10-15 items. It is possible to formulate the result as follows: IF THE DESIGNER "INVENTS" A NUT, HIS PAY IS OFTEN GREATER THAN WHEN HE WORKS ON A SERIOUS THEME WHICH DOES NOT HAVE ANALOGUES IN THE COUNTRY.

The introduction of one very complicated item is stimulated significantly less than, say, the introduction of a new electric motor with a run of tens of millions of copies. If an impact per motor in the amount of 5 rubles is obtained, 5 million rubles is obtained from 1 million motors, but what will you get from one introduced complex?

HOW IS ONE TO DETERMINE THE ECONOMIC IMPACT FROM THE TRAINING OF PERSONNEL IN OUR SIMULATORS? It is possible to have a regular labor force of the highest skill, but the enterprise for some reasons or others will not fulfill the production assignments. Hence, there is no impact. And since there is no impact, there is also no material stimulation, the interest in the search for new solutions is lost. What does the developer have to do with this? Today even the State Committee for Science and Technology cannot answer this tricky question.

INCIDENTALLY, A SIMILAR PICTURE IS ALSO BEING OBSERVED IN ROBOT MAKING.

The acceleration of scientific and technical progress requires the shortening of the length of the "research--development--production" process. The problems, which our experimental design bureau is solving, require a long time--3-4 years. Can we shorten the time? We can, if we eliminate some obstacles and barriers in the way of the designer-developer.

The first is the number of documents, which require various consultations and the collecting of signatures, the number of which at times comes to 10. This is inordinately many and the time is extended (someone, at some time prescribed for himself, for a peaceful life special time limits for getting agreement on documents, and now no one is taking the risk of revising them!). Not only months of invaluable time (we have calculated: about 20 percent of the development period), but also travel allowances, which are a burden on the value of the performed work and increase its cost, are spent on these consultations.

If we have begun a listing, it is necessary also to say a second thing. At one time, when they introduced the Unified System of Design Documentation (YeSKD), they pursued the goal of establishing order in this matter. Time passed, practical experience showed the effectiveness of this system for the development of large series of machines and instruments, but for the rapid development of a new custom item it became a hindrance, since it requires very large expenditures of time on paper work. Exceptions, an abridged version, something is needed in this system.

How many times they have already both said and written that, except for the reports of the Central Statistical Administration, no one has the right to demand from organizations and enterprises any other data. But they continue to come--questionnaires of many pages and detailed forms, in which it is necessary to insert figures which do not give either the mind or the heart anything, and then to add up the results horizontally and vertically.

I also want to speak about the continuing information "famine" of our developers. This is the third thing. There are sectorial scientific research institutes and centers of information, there are also intersectorial ones. But try to get promptly the necessary information! It is good if they respond to an inquiry in a month. At times one has to wait even longer. And all this time our leading specialist sits and works on the invention of the same "nut," which could have been invented 10 years ago.

The entire system of information, patent, and license work from top to bottom needs serious reorganization. Here, for example, the information service consists of two people (according to the standard), moreover, one of them is a translator. What can they do? Practically nothing. But not ordinary, not common, but selective information is needed--for the specific theme, for the specific developer, for the individual research laboratory. Surveys with respect to the themes of the design bureau on domestic and foreign works and on each problem that interests us are needed. But they are not available.

If they were to allow us (away with the standards), we would include within each developing department, at the level of a leading specialist, one information worker. Let him work on a contract: if he has been able, say, by his contribution to speed up development, he will receive the corresponding additional bonus to the salary. If he has done nothing and the work was delayed through his fault, he pays from his own pocket. And it is necessary to include this specialist on the staff of a laboratory or department, which has also been changed over to a contract.

And, finally, a final thing. The simulators being developed by us are produced on the basis of computer technology. When concluding a contract with an enterprise for the development of a system, we select ourselves the appropriate computer. For its delivery it is necessary to submit an order to the Soyuzsistemkomplekt 17 months in advance. The developer begins the work, coupling it with the ordered machine. But after a year it turns out that either they have removed it from series production or they offer another one, which differs in the characteristics and parameters. Hence, away with the entire completed part of the work, start from the beginning!

One's head spins at times from such squabbling. You either read documents or write responses to them. You look, and a day has passed, and 2 days have passed, and again it is necessary to come to an agreement, to have it out, to search, to send someone on a business trip to the main administration to get a single signature on the technical assignment on the theme. But everything is known: what we are doing, how we are doing it, and in what time. The business trip ought to be replaced by a telephone conversation and a telegram in reply with just the one word "Agreed."

Everything, about which I have told, is not complaints and not subjective inventions, but vital requirements. These questions worry, obviously, not only us, the reorganization of our activity in the shortest time is needed, as is air. M.S. Gorbachev spoke about this both at the recent CPSU Central Committee Plenums and at the meeting with economic managers and scientists. All this is due to the need for the acceleration of scientific and technical progress.

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CSO: 1814/159



## TRAINING AND EDUCATION

### DISSERTATIONS, TRAINING, CERTIFICATION OF SCIENTISTS

Moscow LITERATURNAYA GAZETA in Russian 5 Feb 86 p 10

[Article by Oleg Moroz: "The Dissertation... For the Sake of What? We Continue the Discussion of How to Ensure the Constant Influx of Fresh Forces Into Science"; first three paragraphs are LITERATURNAYA GAZETA introduction]

[Text] The article of Doctor of Juridical Sciences Professor V. Savitskiy, "The Ritual Called 'the Defense'," was published in LITERATURNAYA GAZETA for 28 August of last year. The basic idea of the article is: the defense of a dissertation in its present form is nothing but a mere formality, the outcome of which has been determined beforehand. The main reason for such a situation, as the author believes, is the actually established procedure of appointing the official opponents--according to the principle of their complaisance and "benevolence" with respect to the author of the dissertation and the scientific supervisor.

The editorial office received many responses to this publication. Excerpts from them were published in LITERATURNAYA GAZETA for 23 October of last year.

Responses continue to arrive. Now, in connection with the discussion of the basic party documents, the readers propose to examine the problem of the training and certification of scientists more extensively.

How is the influx of fresh forces into science now occurring? The opinions of our readers, which are contained in the letters which are coming to the editorial office these days, are most diverse: from complete satisfaction and conciliation to complete dissatisfaction.

"I am firmly convinced that the system of the training and certification of new scientists, which has been adopted in our country, justifies itself, although it does need further improvement" (Doctor of Medical Sciences Professor Yu. Kvitnitskiy-Ryzhov, Kiev).

"The present system of the certification of scientists is opposed to science and does not satisfy the demands to accelerate scientific and technical progress. Imitation, compilation, plagiarism, imaginary collaboration, protectionism, the use of one's official position, and other abominable things



have bloomed in a double flower" (Candidate of Technical Sciences N. Mamedzade, Moscow Oblast).

The sensation is that the authors of these two quotations are speaking about a different thing, and not about the same thing.

Of course, the opinion of each one reflects his own experience. At any rate, since the task of the cardinal acceleration of scientific and technical progress is being posed today, this alone deprives us of the right to view the state of affairs as satisfactory.

#### HER MAJESTY THE DISSERTATION

The influx of fresh forces occurs mainly through dissertation channels, and they, in the opinion of many, incessantly create obstacles in the way of the normal flow of blood.

"People mainly come to science not to engage in science (except, perhaps, for students, who still perceive science in a different way), but to write a dissertation" (Doctor of Medical Sciences Professor V. Figurnov, Blagoveshchensk).

How did it turn out that way? The dissertation, which from the earliest times was considered a scholarly work, pushed into the background other forms of creative scientific work. In LITERATURNAYA GAZETA a discussion was started (scientists themselves started it) on loosening somehow the dissertation yoke, the dissertation oppression--if only getting rid of the second dissertation, the doctoral dissertation, but changes did not come following this.

Since the dissertation mounted the throne, it has dictated to us rules of good form--what to study and how, what first of all, what in 21st place. The main law is not the importance of the theme being chosen, but the ability to be used for a dissertation.

"It seems to me that the shortcomings in science begin with planning. Let us face it, not an interesting theme, direction, unsolved problem, but first of all a theme, on which a dissertation can be written, is chosen" (V. Figurnov).

"The time has come to change the system of choosing the theme which is liable to priority elaboration. It is necessary to choose the most urgent ones, to concentrate on their analysis the maximum efforts. It is necessary to eliminate the possibility to take for elaboration what is called a theme 'on which a dissertation can be written,' that is, something cachetic, far-fetched, but easy to elaborate and defend" (Doctor of Historical Sciences Professor G. Chigrinov, Moscow).

For, it seems, everything is the ABC: urgency, importance, national economic significance, but how difficult it is to squeeze truisms between the wheels and pinions of a mechanism that was once set into motion! Truisms are one thing, the mechanism is another.

"It is not dissertations that should give rise to science, but science itself should produce dissertation authors and dissertations" (V. Figurnov).

Absolutely correct! You are astonished how in passing, at odd moments the bearers of glorious names--scientists of the past--defended dissertations. Strictly speaking, in the present first-class laboratories that I know the situation is exactly the same. However, "on the whole" we are encouraging a completely different thing.

"In his prime, instead of engaging in his favorite work, the scientist collects and reprints in a bulky volume his previously published works, looks for opponents and a leading organization, holds a place in line in a specialized council, waits 2-3 years (at times 5-7 years).... Conduct a poll among the readers of LITERATURNAYA GAZETA, who have defended a doctoral dissertation: How many years did the defense tear you away from active scientific work? The answer will be: for years!" (Candidate of Physical Mathematical Sciences Ye. Bochkarev, Saratov).

"It is no secret to anyone that today the defense of a doctoral dissertation is an obstacle, the surmounting of which involves enormous formal difficulties which often eliminate prominent specialists from their sphere of activity for several years. Is it justified from the standpoint of the national economy?" (Doctor of Technical Sciences Professor V. Brenner, Tula).

"At present a practice, which is ridiculous and harmful to the interests of science, has formed: the scientists, who are not taking part in major theoretical or applied efforts (as a rule, middling people and time servers), have the time and opportunity over a number of years to scribble a 'substantial' doctoral dissertation and to defend it, while truly prominent and leading scientific associates at educational institutions, scientific research institutes, and design bureaus, whose work is connected with comprehensive programs of research and development and is of great importance for the national economy and defense of the country, are extremely overworked--they work 'not as an obligation, but for the love of their work' and in practice are deprived of the opportunity to process carefully the results of their research and to generalize them in a dissertation" (Candidate of Technical Sciences K. Tkach, senior scientific associate, Moscow).

It is an amazing thing: everything is clear to everyone concerning dissertations, and no one can do anything.

#### THE MAIN THING IS NUMBERS

The dissertation is a unit which is convenient for counting. An indicator. Indicators, indicators, indicators.... But someone must also take a look at the essence and cool the bureaucratic zeal!

"They evaluate the chair and higher educational institution nearly always not according to their real activity, but according to the presence at them of doctors and candidates of sciences" (G. Chigrinov).

"The chair, the faculty, and the rector's office are responsible for the timely graduation of dissertation authors and the fulfillment of the plan of the ministry. But is it possible to plan the number of dissertations, to plan inventions? To assume the obligation 'to invent'?" (Candidate of Architecture I. Telyatnikov, Moscow).

The same fate hangs over the specialized councils.

"Every specialized council tries to graduate the maximum number of specialists. But this principle is good only if there is a developed scientific base in the scientific centers which supply this council. In the absence of such a base, in case of its reduced potentials the councils begin to engage in strained interpretations" (Doctor of Technical Sciences Yu. Kholopov, Moscow).

The bureaucratic kinks are caused not by just someone's stupidity and thoughtlessness, but also by the very flow line production of scientists. The number, the number, the number.... Who fell short there? And how did he dare? And there are already 1.5 million scientists in the country, a fourth of the world army. But they are yielding not a fourth of the output!

Bravery is needed to stand in the way of this flow: "Citizens, think why we are doing this!" Recently Academician V. Sokolov opposed on the pages of LITERATURNAYA GAZETA the reckless production line and flow line nature--true, in the area of higher education.

Incidentally, the reckless increase of the number of scientists is also an extensive approach, and now, as is known, war is being declared against it everywhere.

They set down the evaluation not only for the chair and council, but also for a specific person--the scientific supervisor--according to the number of "degreed people." If the work with graduate students is not going very quickly (from the "demonstrative," bureaucratic standpoint), this means that the supervisor is poor. Will everyone have the strength to oppose the pressure of bureaucrats?

"This is a continuation of the faulty school system: the instructor, who gave a pupil a poor grade according to his deserts, dooms himself to censure in the collective, since by this he has let down the school, the rayon, the city, and so on and has ruined the indicators" (B. Kovalev, Moscow).

"I have had occasion more than once to attend conferences of every kind, when they threatened to deprive the respected professors of their graduate students, since the latter do not 'defend themselves' in time. Here the respected scientific supervisors try by hook or by crook to pull their wards 'by the ears'" (Ye. Beloglovskiy, Chelyabinsk).

"The exaggerated, in my opinion, importance being attached to the defense of the graduate student 'on time' arouses alarm. It creates appreciable pressure on the scientific supervisor and frequently leads to undesirable compromises" (Doctor of Technical Sciences Professor I. Vulfson, Leningrad).

"It is time to cut off from the degree seeker and graduate student the scientific supervisor who has been specially attached to him. Precisely the scientific supervisor frequently pushes into the midst of scientists something inappropriate, a rotten good. He does this not by chance, but because he is personally responsible for the awarding of a degree to the graduate student" (G. Chigrinov).

"It is best of all to eliminate completely the status of a scientific supervisor, having left him as a consultant" (Candidate of Technical Sciences B. Patchezarov, senior scientific associate, Moscow Oblast).

This cascade of accusations meant for the mania for percentages of no longer the school, but graduate studies and the seeking of degrees is serious. In the end the freshly baked candidate of sciences is not yet the end, but the intermediate result of the production of scientists. But now the dominant trend is to judge everything according to the end result and to count the chicks in the fall.

"NO ONE IS LOOKING AT THE ESSENCE...."

Just as in past years, in the mail there are many laments and groans concerning the extreme bureaucratic nature of dissertation affairs.

"During the period before the defense no one looks at the essence of the work, its novelty, and, what is the main thing, the practical value. The esthetics of the drawing up of an enormous number of documents is in first place: they will direct attention without fail to the format of the document, the spacing between the lines, what is written at the beginning--doctor of sciences or professor. The degree seeker is familiar by hearsay with the fact that it is desirable to draw up the documents not on Soviet paper, but on Finnish paper, and those who defended themselves earlier will give him advice on where to get hold of this paper.

"But what about the literature published on the theme of the dissertation?! Here everything is even more complicated. Every article or book should be submitted in three copies. Meanwhile publishing houses now send to authors only one or two copies each of the works. What is one to do here? If an article was published not in Russian, a translation, which has been certified by the director of the corresponding publishing house, should be attached to the work. Imagine that three articles of yours have been published--in Tatar, Uzbek, and Kazakh. Hence, before the defense you will have to visit Kazan, Tashkent, and Alma-Ata in order to have signatures and seals put on the Russian test of the articles. And it is good if on the day of arrival or the following day the director of the publishing house will have a reception 'for personal questions'..." (Candidate of Pedagogical Sciences A. Yefremov, Bugulma).

"Those who have gone through the thorns of the defense, obviously, remember how many troubles, nerves, and time are required for drawing up documents for the submitting of a dissertation to the Higher Certification Commission. At times the size of the folder with various inquiries, responses, certificates,

excerpts, references, annotations, and so forth is equal to the size of the dissertation. The existing procedure of official registration gives rise to bureaucracy in the scientific environment, increases the formalistic trends, and diverts a large number of people from their immediate duties" (Candidate of Philosophical Sciences M. Glotov, Leningrad).

Our love of senseless matters is worthy of astonishment and a monumental statue. With such zeal, with such great diligence to draw up a large volume, whose subsequent fate is to gather dust unclaimed on some remote library shelf, until it is written off as scrap paper or eaten up by mice! I am not speaking about the other, accompanying documents.

"A dissertation, which arrives at the archives of the Higher Certification Commission and at the special collection of the State Library imeni V.I. Lenin and then arouses the interest only of a person who is working on a similar theme, does not have the slightest influence on the real development of science. It is useless. The enormous labor spent on its preparation and defense is also useless, from a public standpoint" (Candidate of Economic Sciences Docent V. Masalskiy, Donetsk).

"Dissertations are written and live by themselves, while industry receives benefit from them in the form of a rarest exception. Having developed more than 27 different machines, many of which were the first Soviet solutions which did not have precedents in foreign reality, I can hardly name more than 3 or 4 dissertations which have been used in my practical work" (Doctor of Technical Sciences N. Astrov, Hero of Socialist Labor, Moscow).

Let us heed the words of an old designer.

"If a miracle were to happen or the real, and not far-fetched improvement of the procedure of the defense proved possible, it should apply to the drawing up of a dissertation. It would be sufficient for the dissertation author to generalize his results and to draw from them the basic conclusions, without preparing a full-length manuscript which is intelligible to hardly anyone and, as a rule, no one needs" (Doctor of Biological Sciences Professor G. Buznikov, Moscow).

It seems a miracle to the respected professor that something here can turn in an intelligent direction--so beaten is the path, so deep is the rut.

#### SPECIALISTS NOT IN A SPECIALTY

Do we rarely at various meetings raise our hands and vote for a thing that we do not know thoroughly? It seems that in the scientific council, in which the dissertation is discussed, the subject of the discussion is thoroughly clear to everyone. Of the 20 members of the council there may turn out to be 3 or 4 genuine specialists who understand the essence of the matter.

"The fact that of the total complement of the specialized council (15-20 people) only 3-4 people can judge in a qualified manner the merits of the work being defended, is abnormal..." (Doctor of Technical Sciences Professor A. Kusov, Leningrad).

Doctor of Technical Sciences Professor V. Beletskiy of Odessa proposed to take into account during the voting in case of the defense of a dissertation the votes of the members of the council, "who ensure the specialty," separately from the rest of the others. They refused: it will complicate the voting procedure. But the only complication is to put out another box with a hole.

True, it is not clear in general why one is to submit a scientific work to the judgment of men, the majority of whom have a vague idea of the subject and merely by a sensitive ear detect the nuances and intonations in the arguments of a few truly competent people.

"It is time to reject the unwieldy scientific councils, on which at times people, who are very far from each other in their scientific interests and training, are included" (G. Chigrinov).

Where will you recruit specialists for each microspecialty? It is difficult. But there is occasion for thought.

"Truly specialized councils, on which scientists from various higher educational institutions of the country would be included, should be set up" (A. Kusov).

"It is possible to get a competent discussion only when recognized specialists in the theme of the dissertation gather for the defense. It is difficult, it would seem, to do this. However, the paradox is that it is not necessary to organize such meetings--they are envisaged by the very structure of scientific activity. These are the numerous all-union and republic conferences, symposiums, seminars, and meetings. It seems reasonable to use such meetings, along with the doctoral councils, which shown themselves to advantage, for defenses of doctoral dissertations" (Candidate of Physical Mathematical Sciences S. Kontush, Odessa).

But what if one does entirely without a defense?

"It is necessary to organize a public defense only if a negative response to the dissertation (or the author's abstract) has been received or if the opponent or any of the members of the council insists on a public defense" (Doctor of Physical Mathematical Sciences Professor V. Malyshev, Taganrog).

#### AFTER THE WEDDING

It has somehow become the custom to reduce everything to the dissertation: we are discussing how to learn to distinguish a little more clearly a bad one from a good one. What happens after the defense no longer interests us, just as it does not interest the author of a romance novel what happens after the wedding. But life does not end with the defense of a dissertation.

"The failure in science, in my opinion, appears not before, but after the defense of the dissertation. Having received the cherished degree, a person can clip coupons all the rest of his life. This happens when no one demands anything of the scientist, when they judge his work according to formal



indicators: so many articles, so many reviews.... And the young scientist gradually turns into an old docent or professor, who no longer wants to perform. Why? For no one demands it. But it is possible to gather a load at examinations and seminars" (Candidate of Technical Sciences Docent V. Kiselev, Kiev).

"It is necessary to introduce everywhere the practice of replacing the managers of laboratories, departments, and so on, who have not produced in 5-10 years anything that would be accepted by the national economy" (Candidate of Technical Sciences A. Zinovyev, Moscow).

"Perhaps, it is advisable that once every 5 years the person who defended a dissertation would confirm his degree. It is a matter not of a repeated defense, but that a person would tell about his scientific work, publications, plans. If he is doing nothing, is not yielding a return, has not become a genuine scientist, it is possible to raise the question of depriving him of the degree" (Doctor of Juridical Sciences Professor V. Oygenzikht, Dushanbe).

Is it impracticable? Is the confusion great? All the same there is something in this. Some control is needed. Or else it happens that a person abandons science the day after the defense, but flaunts the title of candidate or doctor of sciences to the end of his days.

"Many newly made candidates scandalously quickly forget their scientific work, if the opportunity to get a more advantageous job, even if it is 'not in the theme,' presents itself..." (V. Fonvizin, Leningrad).

#### PAYING FOR A GENUINE CONTRIBUTION!

The most burning question is the increments for a degree. Many people see in them the root of all the evils, to which our science is prone.

"The decision on the abolition of all percents for academic degrees and titles would be entirely correct. This measure played its role when there was a shortage of scientists in the country. Now there is no shortage, and the increment plays merely the role of bait for rogues" (A. Zinovyev).

"The wage of a scientist should be governed...by the work actually being performed by him and by the real benefit being provided, and not by the degree of doctor or candidate of sciences" (Doctor of Medical Sciences Professor P. Zabludovskiy, Moscow; Candidate of Medical Sciences V. Gritskevich, senior scientific associate, Leningrad).

"I can name just one figure for one plant: in 20 years the number of candidates of sciences, who work at this plant, has increased 800 percent (!). Apparently, there is no further need to grant increased salaries and salary increments to people who have academic degrees. Here only those who are actually interested in the development of science, and not in the acquisition of material goods, will defend dissertations" (Candidate of Technical Sciences L. Sergeev, senior scientific associate, Leningrad).

"In production advanced forms of the remuneration of labor: cost accounting, the collective contract, and so on, are presently being promoted and introduced. In particular, the associates of scientific research institutions are recommending these forms. But what right do they have to give such recommendations, if at the scientific institutions themselves there is such imperfection in the remuneration of labor, such a "spread" between the wage of associates with a degree and without a degree!" (a woman associate of the Siberian Department of the All-Union Academy of Agricultural Sciences imeni V.I. Lenin, Novosibirsk).

"There is a simple means against the appearance of weak, useless works--one must not pay for the degree, but must pay for the work which the specialist performs" (Doctor of Technical Sciences Professor G. Shapiro, Moscow).

Now such suggestions come not from detached people, who are alien from science--they come scientists themselves, who are taking the matter to heart.

The wishes, however, were late: the new system of the remuneration of labor, in which there is no place for increments, is already beginning to be introduced (see the publication "Not for the Degree, But for Labor," LITERATURNAYA GAZETA of 15 January of this year).

#### TO BE A SCIENTIST MEANS TO BE IN LOVE

When it is a matter of the progress of science, perhaps, there are more important questions than dissertations, degree, and increments.

"If you ask an actively working scientist (in any case a social scientist) what, in his opinion, are the main shortcomings which are preventing our science from fulfilling its duty to the people, he will most likely name the low productivity of scientific labor and the incredibly difficult path from theoretical research to practice. As to dissertations.... Weak dissertations emerge in case of the generalization of the results of weak scientific works. The increase of the level of scientific work of the corresponding collectives, the campaign for the elimination of the main shortcomings of the scientific process--these measures will simultaneously lead also to the increase of the quality of the 'fresh forces' which are replenishing science" (G. Buznikov).

All that is so. But for some reason precisely when the discussion turns to dissertations and degrees--it would seem, a special question, a flow of unusually intelligent, practical, ardent, civic letters, in which the most broad problems and the most universal materials are interpreted, rains down on the editorial office. Such a discussion was begun last year by Professor A. Kitaygorodskiy ("Is It Fruitful? It Is Profitable!", LITERATURNAYA GAZETA, No 30) and Professor V. Savitskiy ("The Ritual Called 'the Defense'," LITERATURNAYA GAZETA, No 35), and now on the editorial office desks there are piles of letters which the only thing to do is to open....

Everything, everything that the eye sees on newspaper pages, that the ear catches in today's radio and television broadcasts--"acceleration," "progress," "updating"--is in these letters.



Suddenly--like a flash-up, a flash of a flare among the exclusively practical, rational lines:

"To be a scientist is the same thing as to be in love, that is, this is a special state of mind and soul. And just as a marriage certificate certifies merely the fact of the birth of a family and says nothing about the feelings of the people who form it, so the candidate or doctoral diploma certifies merely the skill of its holder, while saying nothing about his spirit and ability to become a scientist" (Candidate of Chemical Sciences V. Rybinov, junior scientific associate, Moscow).

And an unusually broad name has also been found for this--"the human factor." No matter what reorganizations and reforms are undertaken, the final word will always remain with man, with his abilities and moral and other qualities. In science, as in any other creative field, this truth is thrice true.

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CSO: 1814/160

## AUTOMATION AND INFORMATION POLICY

### TRENDS, APPREHENSIONS ABOUT COMPUTERIZATION IN WEST EXAMINED

Leningrad LENINGRADSKAYA PRAVDA in Russian 5 Jan 86 p 3

[Article by G. Aleksandrovich under the rubric "International Notes": "The Road of Disappointed Hopes"]

[Text] The Viennese DIE PRESSE reports: New Year's eve public opinion polls in the developed industrial countries of the West attest to the increasing mistrust and fear of "the man on the street" with respect to computers.

Apprehensions are being voiced concerning the fact that the universal introduction of computers in the sphere of production, means of communications, and military equipment can lead to mass unemployment, increase the interference of the state and employers in the private life of people, and increase the risk of the occurrence of accidents, catastrophes, and even a third world war as a result of a random error of a computer. Such moods are appearing especially often in the FRG, Italy, and Holland, but even in the United States, where, if you believe the American press, the computer long ago turned into a "national hobby," not less than 20 percent of the surveyed people acknowledged them.

Such a situation is forcing to ponder the ideologists of what is called "postindustrial society," who for several decades now have been suggesting to the masses that scientific and technical progress and first of all "the computer revolution" are capable in themselves of creating the conditions for the all-round development of the human personality, the overcoming of the social conflicts between people, and the reigning in the capitalist West of the Christmas atmosphere of mutual love and cooperation. However, now some of the above-mentioned ideologists are willing to admit that their optimistic predictions did not come true, but they are inclined to place the blame for this on..."the incomprehensible ways" of technical progress itself.

Professor E. Brown of the Chair of Technical Policy at the University of Aston (Great Britain), who frequently appears on the pages of the London weekly THE NEW SOCIETY, provided one of his studies with the following title--"Capricious Technology."

Yes, Brown agrees, people's fear of the latest technology in contemporary bourgeois society is based on quite real reasons of a social nature. The

extensive introduction in production of microprocessors and robots is inevitably leading to the increase of unemployment. Computer-controlled machines are assuming many functions among those which man previously performed. As a result "the polarization of skills" is emerging; the knowledge and experience of the bulk of workers are turning out to be depreciated, and at the same time an increased need for a new type of worker--the operator of automated systems--is arising. The threat of losing their job hangs not only over "blue collar workers," that is, the workers, but also over "white collar workers"--office employees, and even over managers.

E. Brown also does not deny another negative consequence of the daily use of microelectronics in the West--the large-scale use of computers for the gathering and storage of information which concerns the private life of citizens. "More than 13 million files on the citizen of Great Britain have been compiled with the aid of computers," he grieves. The use of electronic bugging devices at enterprises "intensifies among people the sense of alienation and isolation and reduces to a minimum their social contacts and cooperation in the production process."

This sense of isolation also does not leave man at home. "Under the conditions of modern technical achievements he has everything except the joy of contact with other people," Brown notes ironically. "In order to hear a warm word, he has to buy a Japanese robot which greets him every morning with a pleasant electronic voice."

Professor J. Bolter of the University of North Carolina (the United States), who, like E. Brown, is one of the advocates of "technological determinism"--a bourgeois methodology which recognizes the decisive role of technology in the development of society--also writes with alarm about the process of the dehumanization of Western society, which has been aggravated as a result of "the computer revolution."

"The social atmosphere in which we live and work," he states, "has been poisoned by new machines. The possibility to associate with each other as human beings is being lost under the conditions, when each of us is viewed not as an individual who has specific peculiarities, but as an identification number, about which specific information is available in a data bank. According to the prevailing point of view, everything that is of interest in a person can be expressed quantitatively and fed into a digital computer."

In the opinion of Bolter, the programmer's playing with computers is becoming the basic form of human self-expression in the West. Not finding satisfaction in his job and in general in the surrounding world, a person creates computer models of other, fantastic worlds, and these fantasies, which have been fed into the computer, acquire independent life and become perceptible to the senses on the display screens. The number of what are called "hackers"--obsessed programmers who get carried away by their power over imaginary worlds--is increasing rapidly. Illusions become reality for them, the game becomes real life. "In this way Western society is gradually turning into a civilization which is completely dependent upon the computer," Bolter bitterly concludes.

But why make such a fetish of the computer and turn it into some self-sufficient force which came from who knows where? It is a question of a device which was developed by man. But since this is the case, when evaluating this device one should proceed from who uses it and for what purposes. It is hardly possible, for example, to doubt that for the capitalist employer the computer is a tool of the derivation of an excess profit, which enables him to achieve a significant decrease of the outlays on the remuneration of labor and the training of workers of the corresponding skill. Or, say, that the government of the imperialist states sees in microelectronics a powerful means of controlling the minds of its citizens. Control which is carried out by no means only by instilling them with a sense of fear. For if you look into it, the notorious "hackers" are the product of the very cunning and crafty policy of state monopoly capitalism in the sphere of information science. A policy, the goal of which is to divert the masses from the struggle for the improvement of living and working conditions, having slipped them an absorbing "game."

It is becoming more and more difficult for "technological determinists" to take shelter from these realities behind the cloak of abstruse terms like "the polarization of skill." Not by chance does the same E. Brown, having forgotten for a moment "the uniqueness of technology," appeal to employers "to take technical policy beyond narrow economic interests."

Alas, this appeal sounds like a voice in the wilderness.

American scientist Norbert Wiener, "the father of cybernetics," 30 years ago wrote: "It is difficult to restrain industrialists in any way, when it comes to the derivation from industry of all the profits which it is possible to derive from there, in order then to leave it to society to be satisfied with crumbs."

The industrial practice of the capitalist states in past decades does not give any grounds to believe that the psychology of "the captains of industry" in this time has changed for the better.

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CSO: 1814/159

## PATENTS AND INVENTIONS

### TRAINING, STATUS OF PATENT EXPERTS NEED IMPROVEMENT

Moscow IZVESTIYA in Russian 10 Feb 86 p 2

[Article under the rubric "The Personnel Question" (Moscow): "A Specialist Without a Specialty"; capitalized passages published in boldface]

[Text] Patent policy is becoming more and more closely a component of the scientific and technical policy of our state. The active use by the country of foreign trade operations is making increased demands on the technical level of products and the assurance of their patentability and competitive ability abroad. Indeed, last year alone 63,800 inventions were registered in the USSR. Now more than 25,000 patents, which have been issued for Soviet inventions, are in effect in 70 countries of the world. In 1985 about 1,100 patents were issued to foreign organizations and firms.

There is no need to show how necessary specialists, who are capable of independently and creatively selecting and formulating urgent problems and of finding effective means of their solution, are. These demands fully apply to patent experts, who are called upon to be genuine pilots of technical progress.

In spite of the many years of experience of training the corresponding personnel, the position of patent expert for a long time did not find reflection in the Unified Classification of Positions of Employees (YeNDS) and in other consolidated standard documents of competent organs. Only in 1973 did two positions--chief and engineer of the patent department (bureau)--prove to be included in the all-union job manual. And everything was confined to this. Of course, such a narrow approach to the important matter made itself felt--many specialist-patent experts to this day are also forced to hold "alien" positions, and, hence, their situation is unstable. Patent experts often do not have the prospect of advancement, which adversely affects their work and leads to the turnover of personnel and to other undesirable consequences. And there is more. According to the charts of salaries patent experts for the present have not yet been grouped with workers of the basic subdivisions of enterprises and organizations, and this is hindering the enlistment in patent and license work of highly skilled personnel. One need not be surprised that some patent experts, not wishing to burden themselves with much work, are frequently inclined to resort to "little tricks."

For example, to the following ones. All-Union State Standard 15.01-82, which makes it incumbent to conduct patent research--important, very difficult work--was put into effect starting in January 1984. Some go-getting patent experts with the assistance of the management of the enterprise by hook or by crook (of course, with references to the specific nature of the sector) are trying to get from the State Committee for Standards to work "temporarily," as "an exception" in the old way. And this is understandable, since at present casual workers with an engineering education frequently turn out to be patent experts. Moreover, they lack any advantages even after successfully graduating from educational institutions--the administrations of the enterprises and organizations, which sent them to study, are not obliged to increase their salaries....

Where is the way out of the formed situation? It seems that it is necessary to legitimize more quickly the positions of patent experts, to include the specialty "patent studies" in the mentioned classification of the Higher Certification Commission, and to interpret it.

In the draft of the Basic Directions it is stated with every reason: "To increase the quality of the training of specialists and the improvement of the skills of personnel, first of all in new specialties which are connected with scientific and technical progress." Undoubtedly, this general formula also has to do with patent experts. However, it would be very important to speak about this specially. It seems, therefore, advisable to supplement the next provision of the draft of the Basic Directions: "To improve inventing, patent, and license work" with the following phrase: "TO IMPROVE THE TRAINING OF PATENT EXPERTS, TO STRENGTHEN THE STATUS OF THE EDUCATIONAL INSTITUTIONS THAT TRAIN THEM."

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## PATENTS AND INVENTIONS

### INVENTION, PATENT WORK AT ACADEMY OF AGRICULTURAL SCIENCES

Moscow SELSKAYA ZHIZN in Russian 10 Jan 86 p 2

[Interview with Georgiy Semenovich Gudkov, chief of the Agriculture, Reclamation, and Water Resources Department of the USSR State Committee for Inventions and Discoveries, by E. Nikolskaya, correspondent of the press center of the USSR State Committee for Science and Technology: "Innovations Must Be New!"; date, place, and occasion not given; first paragraph is SELSKAYA ZHIZN introduction]

[Text] The USSR State Committee for Inventions and Discoveries has checked the state of inventing, patent, and license work at the scientific research institutes of the All-Union Academy of Agricultural Sciences imeni V.I. Lenin. E. Nikolskaya, a correspondent of the press center of the USSR State Committee, in this connection addressed to G.S. Gudkov, chief of the Agriculture, Reclamation, and Water Resources Department of the State Committee for Inventions and Discoveries, the request to answer several questions.

[Question] Georgiy Semenovich, how do you rate the level of inventing and patent work at the institutes of the All-Union Academy of Agricultural Sciences imeni V.I. Lenin?

[Answer] The fulfillment of the Food Program is a national matter. One of the most important conditions of success is the development of fundamentally new equipment and advanced technologies. It is necessary that the creativity and inventive thought of the workers of agriculture would be organized according to a precise plan, without diverting attention to the invention of any kind of "bicycles." The machines, mechanisms, and technological processes, which are being newly developed, should be truly new ones, and not simply improved old ones. It is impossible to achieve this without reliable patent services which have skilled personnel and sufficiently complete reference collections. This seems to be clear to everyone, but for the present appreciable changes are not being observed. The underestimation of patent work leads to the appearance of, for example, such curious things as the "cotton extractor," which was "invented" at the Central Asian Scientific Research Institute of the Mechanization and Electrification of Agriculture. When its developers submitted the application for invention, the expert commission opposed to every paragraph of the formula of the proposed invention



published inventor's certificates which were issued during the period from 1929 to 1979.

Of course, the appearance instead of a very necessary machine of such, if one may say so, an innovation is a waste of time, assets, and efforts. But the overall state of affairs with the patent service at a number of scientific institutions of the All-Union Academy of Agricultural Sciences imeni V.I. Lenin is causing even greater alarm. During the past five-year plan 12 applications for discoveries were submitted, but only 1 was recognized as such. The others were rejected as ones which do not satisfy the requirements.

The situation with inventions is also the same. The applications submitted by the institutes of the All-Union Academy of Agricultural Sciences imeni V.I. Lenin are frequently rejected because they do not contain essential differences from other technical solutions--domestic and foreign. For example, of the 99 applications submitted by the Tselinselkhozmeckhanizatsiya Scientific Production Association two-thirds (65 applications) were rejected by the experts precisely for this reason. And even the works, which are submitted for academic degrees--this, it would seem, is where the latest word in science should be heard--can far from always be protected by certificates of authorship for inventions, that is, in reality by certificates of genuine novelty and priority. Only 11 percent of the total number of candidate dissertations, which have been defended in recent years, have contained innovations at the level of inventions, while of the doctoral dissertations a little more than half did.

[Question] Like it or not, the impression is created that many staff members of the institutes of the All-Union Academy of Agricultural Sciences imeni V.I. Lenin, when beginning the development of new equipment, do not take the trouble to study thoroughly the problem in which they intend to make a fresh departure....

[Answer] So it is. But not one most distinguished specialist can rely today on his own knowledge--science and technology are progressing so rapidly. At each stage of development thorough patent research is necessary, a patent expert should always work alongside the inventor. Precisely he will help the developer to determine the most efficient direction of research and to analyze the results of creative work at each stage of it.

[Question] What is the patent service of the All-Union Academy of Agricultural Sciences imeni V.I. Lenin like in its present form?

[Answer] There are 19,000 scientific associates on the scientific staff of the academy. They are served by 283 patent experts, the majority of whom do not have specialized training. At several institutes other workers perform the duties of patent experts through the combining of jobs. For example, at the All-Union Scientific Research Institute of Selection and Genetics (Odessa) there is one patent expert, he is the translator, he deals with the questions of standardization. But patent research requires intense work. And this, unfortunately, is far from an isolated example.



[Question] What steps have been outlined by the academy on the improvement of matters in inventing, patent, and license work?

[Answer] It is deemed necessary henceforth to evaluate the activity of institutes with allowance made for this work. But in general it is not necessary here to invent anything. There exists a state standard which dictates that patent research in case of the development of new equipment is a mandatory stage of the work. In other words, patent research has been elevated to the rank of a law, and the law should be carried out.

But, of course, the most reasonable law will remain on paper, if there is no one to carry it out. As we see, that is precisely how the matter stands for the present. It is impossible to expect that patent services will arise and will begin to work effectively immediately. You will not establish them by order alone. The patent expert should be a specialist in his own field and, moreover, should also know patent affairs, that is, should essentially have a second specialty. It is necessary to train such workers from among the most competent, intelligent specialists. Now, when the patent services have been put on the same level, finally, with the basic scientific subdivisions, this has become possible, but given this condition much time will be spent on the formation of reliable patent subdivisions and on the creation of exhaustive sectorial patent collections. Therefore, one should set to work on this most important matter as promptly as possible.

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CSO: 1814/159

## REGIONAL ISSUES

### INTEGRATION OF SCIENCE, TECHNOLOGY, PRODUCTION IN KAZAKH SSR

Alma-Ata KAZAKHSTANSKAYA PRAVDA in Russian 31 Jan 86 p 3

[Interview with Corresponding Member of the Kazakh SSR Academy of Sciences Dzhantore Nurlanovich Abishev, academician secretary of the Central Kazakhstan Department of the Kazakh SSR Academy of Sciences, by KAZAKHSTANSKAYA PRAVDA correspondent N. Belov: "In Close Cooperation"; date, place, and occasion not given; first paragraph is KAZAKHSTANSKAYA PRAVDA introduction]

[Text] In the draft of the Basic Directions of USSR Economic and Social Development for 1986-1990 and the Period to 2000 it is noted: "...To strengthen the contact of science and production, to develop such organizational forms of the integration of science, technology, and production, which make it possible to ensure the efficient and rapid passage of scientific ideas from conception to extensive use in practice." Our correspondent met with Corresponding Member of the Kazakh SSR Academy of Sciences Dzhantore Nurlanovich Abishev, academician secretary of the Central Kazakhstan Department of the Kazakh SSR Academy of Sciences, and asked him to tell how these problems are being solved by the scientists of Central Kazakhstan.

[Question] The Central Kazakhstan Department of the Kazakh SSR Academy of Sciences emerged about 3 years ago. By what was the need for the formation of the new scientific center dictated and have the goals, which were posed when establishing it, been achieved?

[Answer] Central Kazakhstan has developed industry, a large mineral raw material base, highly developed agricultural production, machine building, and a construction industry. The national economy of the region is closely interdependent with the economy of Kokchetav, Turgay, North Kazakhstan, and Kustanay Oblasts, which increases even more its economic potential. Large reserves of tungsten and molybdenum, coal, iron, lead, zinc, and manganese are concentrated here.

The Yermak Ferroalloy Plant operates on the basis of the manganese and chrome ores of Central and Western Kazakhstan. The Pavlodar-Ekibastuz Territorial Production Complex, in which power engineering plays the leading role, is gaining strength with each year. The Balkhash and Dzhezkazgan Complexes are the basic copper producers in the country. The output of nitrogen

fertilizers, benzene, toluene, xylene, coal tar, and sulfuric acid has been organized at the Karaganda Metallurgical Combine on the basis of the waste products of coke production and the blast furnace process.

The ore and raw material resources of Central Kazakhstan are enormous. But their efficient, complete processing is impossible without the close connection of production workers with modern science. However, the available scientific forces are quite young and disconnected at various academic, departmental, and educational scientific institutions. To unite the scientific forces and to aim them in the direction of the solution of the most important national economic problems--such a goal was posed when establishing the Central Kazakhstan Department.

Much work has been performed on identifying the scientific potential of the eight oblasts of Central and Northern Kazakhstan. Here there are 150 scientific institutions and other organizations that are engaged in scientific activity, at which more than 100 doctors and 2,000 candidates of sciences work. An enormous scientific force! Efficient means of coordinating their activity had to be found. Seven scientific councils for the problems of different fields of science were formed. The basic scientific directions of the problem councils were specified. First of all they are connected with mining, chemical, and metallurgical problems. Among them are the complete development of minerals, the mining of coal without people and shafts, the development of a technology of the processing of local ores at industrial enterprises of Kazakhstan, and environmental protection.

The department for the present is still at the stage of formation. Along with a scientific base we are also thinking about a production base. Preparation for the designing and construction in Karaganda of the first section of the Academy Campus is under way. It is proposed to locate it on an area of 47 hectares in the southeastern part of the city. At present 10 institutes or their departments with a total of 900 people are a part of the department. Substantiations have been prepared for the establishment of new scientific institutions: the institutes of ferrous metallurgy, the complete development of mineral resources, ecology, and the protection of the biosphere.

[Question] The front line of the campaign for the acceleration of scientific and technical progress and the intensification of the economy, as is noted in the pregress documents, passes through science. The successes of Kazakh scientists in various spheres of knowledge and technical progress are universally recognized. At the same time our science is still inadequately turned toward the needs of social production, and production--toward science. The role and responsibility of the academic sciences for the development of the theoretical principles of fundamentally new types of equipment and technology have to be increased.

[Answer] This, of course, is the main task of scientists today. We have already formulated six regional programs of scientific research--"The Miner," "The Metallurgist," "The Chemist," "Automation," "Labor and Health," and "The Virgin Land Worker," which are united into the Central Kazakhstan Comprehensive Goal Program. The conducting of scientific research on various production problems is envisaged. The scientific subdivisions, which belong

to the department, already have to their credit achievements in this work. Thus, for the development and introduction in the metallurgical industry of a technology of processing phosphorous iron ore raw materials, which ensures the production of highly efficient types of sheet products and the possibility of committing to use previously unworkable deposits of this raw material, a group of scientists and engineers was awarded the 1984 USSR State Prize. Developments of our Institute of Chemistry and Metallurgy were also included in this complex.

A new scientific direction is the processing of hard to concentrate pyritiferous polymetallic raw materials and the development of a fundamentally new method of the monitoring and control of the process of the combustion of fuel. Research of scientists of the Institute of Chemistry and Metallurgy is being conducted in the area of the discovery of the mechanism of several successive chemical reactions, which made it possible to develop a number of original technologies of the complete processing of metallurgical raw materials. The improved method of the synthesis of source products for synthetic rubbers and other valuable products, which are so necessary for our national economy, is of great applied importance.

The basic direction of the work of the Scientific Research Institute of Labor Hygiene and Occupational Diseases is the early diagnosis, prevention, and treatment of occupational diseases of workers of the mining, petrochemical, and metallurgical industries. As a result of the introduction of the recommended measures a decrease of the illness rate of miners occurred, the level of the dustiness of the air in the longwalls of the mines of the Karaganda Coal Association and in the shops of the Karaganda Metallurgical Combine was reduced.

The research of the Karaganda Department of the Institute of Mining of the Kazakh SSR Academy of Sciences on the development of a technology and methods of the mining of coal, which eliminate the presence of people at the stope, is promising. The use of this qualitatively new technology and self-propelled robot units will make it possible to increase labor productivity in case of the underground mining of coal by two- to threefold. The department is also engaged in the elaboration of the integrated development of the ore deposits of Central Kazakhstan. Here a new technology of the continuous mining of steep thin deposits has been recommended and a complex based on machines with monorail movement has been developed. Recommendations and methods for the secondary working of the Western Karazhal iron ore deposit--the raw material base of the Karaganda Metallurgical Combine--have been elaborated. This yielded a decrease of the losses at the deposit to one-half.

In addition to the scientific subdivisions, which operate within the Central Kazakhstan Department, many sectorial scientific research institutes are operating in the region. Thus, 10 scientific institutions of the USSR Ministry of the Coal Industry, which are working on the problems of the development of the Karaganda Coal Basin, are concentrated in Karaganda. The higher educational institutions of the region, which are engaging in basic and applied research on the problems of the regional economy, have a significant scientific potential. In Karaganda alone there are seven higher educational institutions. However, all these forces are working separately, which is not

yielding the proper economic impact and is slowing the pace of scientific and technical progress.

[Question] The need to use ore raw materials more completely is spoken about in the draft of the Basic Directions. Karaganda scientists have done much in this direction. It is a question, in particular, of the assimilation at the Karaganda Metallurgical Combine of the technology of processing Lisakovsk ores. What further steps do scientists and productions workers have to take in order to increase the efficiency of the use of Lisakovsk iron ore raw materials?

[Answer] Among the most important scientific problems, which scientists of the region have to solve, is the effective and complete development of the Kustanay iron ore deposits. As is known, for the introduction of a technology of processing Lisakovsk ores, which are concentrated by the magnetic gravity method, a group of scientists and engineers was awarded in 1984 the USSR State Prize. But in essence this is still only the first part of the performed work.

The further development of the Lisakovsk Mining and Ore Dressing Combine, the Karaganda Metallurgical Combine, and other metallurgical enterprises of the region is inseparably connected with the practical solution of the problem of using the ores of the Lisakovsk deposit. All this will require the solution of many intersectorial, organizational, and technical problems. One of these "difficult" problems is the development at the Karaganda Metallurgical Combine of the processing of Lisakovsk ores which have been concentrated by the more advanced, magnetic roasting method.

The advantages of the magnetic roasting method of concentration over the magnetic gravity method are obvious: the concentrate obtained by the former method contains 49 percent iron, by the latter--61-62 percent. But the main thing is that the use in the blast furnace process of magnetic roasted concentrate makes it possible to use ore raw materials more completely. Scientists of the Institute of Chemistry and Metallurgy have developed a waste-free technology of using iron ores. They will be able to turn the large amount of slag, which now goes to the dump, into valuable raw materials: alumina, vanadium, phosphorus compounds. Calculations show: at the Karaganda Metallurgical Combine alone the changeover to the new technology will make it possible to provide an additional 600,000 tons of pig iron a year and to save 350,000 tons of coke. As a whole, according to the calculations of the Institute of Economics attached to the Kazakh SSR State Planning Committee, the saving from the complete use of Lisakovsk ores will come to 100 million rubles a year.

So what is the problem? Today at the pilot industrial plant the Lisakovsk Mining and Ore Dressing Combine produces 200,000 tons of magnetic roasted concentrate. During the 12th Five-Year Plan they will put into operation capacities for the production of 2 million tons of concentrates. It seems that the idea of scientists is being implemented. By in what way? It turns out that the metallurgists now are merely mixing the magnetic roasted concentrate into the magnetic gravity concentrate and also intend to do exactly that in the future. Of course, it is more peaceful that way: it is

not necessary to change the mode of operation of the furnaces. But the impact from such mixing is also negligible: while obtaining metal, they are as before hauling the valuable blast furnace slag to the dumps.

The disregard of the demand to use ore raw materials more completely and to introduce waste-free technology is present. We hope that the metallurgists of Temirtau will find the opportunity jointly with scientists to conduct comprehensive tests of the technology of smelting pig iron from magnetic roasted concentrate. Only such cooperation of scientists and production workers will make it possible to speed up drastically the economic development of the country on the basis of scientific and technical progress.

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CSO: 1814/160

## REGIONAL ISSUES

### BARRIERS TO INTRODUCTION OF INNOVATIONS AT REGIONAL LEVEL

Moscow SOVETSKAYA ROSSIYA in Russian 22 Jan 86 p 3

[Article by Candidate of Economic Sciences A. Kolesov (Petrozavodsk): "The Twelfth Official Stamp. Interdepartmental Barriers Hinder the Introduction of an Innovation in Practice"]

[Text] Imagine the following picture. Some institute, in strengthening the contact of science with production, organized at a sovkhos its own support center. It studied the economy of the farm, identified the strong and weak points of production, and carried out development, and an innovation, which will yield the sovkhos a significant economic impact, appeared.

It remains to legitimize, so to speak, the very fact of the appearance of the innovation and to determine its efficiency. And it is here that long "negotiations" with the board of directors of the sovkhos begins. The economists of the farm and the scientific institution agreed long ago to all the items on introduction and affixed their signatures to the documents, but the director is delaying their approval.

He does not explain the reason, but we understand his indecision--it comes from overcautiousness. Days and weeks pass, finally the certificate is signed, the calculations of the economic impact have been made. But more time will pass before the official stamp of the minister of the autonomous republic or his deputy will appear on this document, and only then will the honestly earned rubles be reflected in the statistical reporting and give moral satisfaction to the collective of the institute in the competition with their friends and rivals from other scientific institutions.

Unfortunately, such a picture is not a rarity. The path of an innovation from development to use in practice is long. Scientists have to visit various institutes, "pushing through" their creation. The taste not only for introduction, but also for applied work is thus lost. Imagine: at the final stage alone--the drawing up of the certificate of introduction of a scientific and technical development (in conformity with standard interdepartmental form No R-10)--it is necessary to fill in 200 different indicators. There are needed for their approval: two signatures of the chief accountant, three simply of an accountant, two of the chief of the planning department, two of the economist of this department, one of the manager of the shop, one of the



chief of the labor and wages department, and one of the manager of the enterprise. In all 12 official stamps for each measure!

But not only bureaucratic obstacles prevent an innovation from being rapidly introduced in practice. As much as they would like, production workers often cannot assimilate it quickly due to the lack of the necessary reserves of capacities and personnel. Here the enterprise needs assistance. It is not very easy to accomplish this within one ministry. The situation is even more complicated at the regional level, where interdepartmental barriers are especially perceptible and harmful.

The lack of a connecting, coordinating link between production and science leads not only to disputes about who should introduce: scientists or production workers? The process of introducing an innovation into practice is slowing down drastically, it happens that it becomes obsolete before it reaches production.

Now in many autonomous republics, krays, and oblasts of the RSFSR there are territorial intersectorial centers of scientific and technical information and propaganda of the USSR State Committee for Science and Technology. However, they deal only with the promotion of innovations, the settlement of questions of introduction is beyond their power. At the same time the USSR State Committee for Science and Technology could organize this work. It seems that it is worth broadening its functions, that is, assigning to its subdivisions the duties of solving the interdepartmental problems of the introduction of the achievements of science in production. The above-mentioned intersectorial centers and introducing "firms," which operate on a cost accounting basis, could perform these functions. Such a solution of the problem will contribute to the successful fulfillment of the most important and long-term task, which is posed in the draft of the Basic Directions: the intensification of integration in the unified agroindustrial complex--agriculture with the corresponding sectors of industry, as well as science with production.

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CSO: 1814/163

## REGIONAL ISSUES

### DEVELOPMENT OF POWDER METALLURGY IN ARMENIA

Yerevan KOMMUNIST in Russian 12 Jan 86 p 2

[Article by Professor N. Manukyan, chairman of the Committee of Powder Metallurgy of the Armenian Republic Board of Scientific and Technical Societies: "The Long Path of a Development"; capitalized passages published in boldface]

[Text] In recent years a special role has been assigned to low-waste production, particularly of powder metallurgy. It was possible precisely by means of it to obtain alloys which it is impossible to produce by conventional technology (tungsten-copper, iron-glass ceramic, steel-polymer, and others); to synthesize systems of materials with a preset structure and the necessary set of properties; to develop the production of parts of machines almost without scraps. For example, in case of the machining of cast or forged parts about 30 percent of the metal becomes chips, while in case of the molding of metallic powders into the same parts the scraps do not exceed 3 percent.

The composite alloys, which are reinforced by high modulus fibers, are called supermaterials. Precisely the methods of powder metallurgy guarantee the obtaining of materials with the maximum strength, which is unobtainable by any metallurgical conversions.

In recent years a wide range of parts of machines of different complexity and for different purposes has been assimilated in the country. Their weight ranges from several grams to hundreds of kilograms, their size ranges from 1 millimeter to tens of meters.

The scientific research in powder metallurgy in the republic is aimed at THE ESTABLISHMENT OF A PILOT INDUSTRIAL BASE AND THE TRAINING OF ENGINEERING AND HIGHLY SKILLED PERSONNEL. In this connection an efficient technology of obtaining iron powder of commercial purity from the ores of the Razdan and Kaputanskiy deposits, bypassing their metallurgical conversion, was developed.

Self-propagating high-temperature synthesis (the SVS process) should be regarded as a new direction in the technology of powder metallurgy. Its theory and practice were developed by the Institutes of Chemical Physics of the USSR Academy of Sciences and the Armenian SSR Academy of Sciences. The synthesis of more than 100 inorganic compounds has been accomplished.

The training of 30 candidates of technical sciences, the operation of graduate studies at Yerevan Polytechnical Institute, the publication of more than 200 works both in the USSR and abroad, and the obtaining of certificates of authorship for inventions should be grouped with the scientific achievements.

All this made it possible to establish a production base in the republic and to expand and strengthen scientific subdivisions.

Unfortunately, the development of powder metallurgy for the most part was accomplished on the enthusiasm of individual scientists and managers of enterprises. THE SECTOR ITSELF REMAINED OUTSIDE THE FIELD OF ACTIVITY OF THE REPUBLIC STATE PLANNING COMMITTEE AND ACADEMY OF SCIENCES. Suffice it to note that in the past 20 years not one decision of directive organs has been made, although there are a number of most important union decrees. Finally, the lack of a coordinating plan of work for 1981-1985 did not make it possible to unite the efforts of scientists and production workers.

Of course, under such conditions it was not possible to do everything. Significant problems arose for the Alaverdi Mining and Metallurgical Combine, which is assimilating the technology of obtaining powders of nonferrous metals by pulverization. The combine needs the assistance of specialists and supply with equipment. They were faced with similar difficulties at the Armelektrodvigatel Production Association.

Many production collectives and special design and technological bureaus of the Institute of Chemical Physics of the Armenian SSR Academy of Sciences are faced with serious dilemmas. All these enterprises constitute the industrial base of powder metallurgy of the republic. Its subsequent fate as a whole depends on their development.

SECTIONS AND SHOPS FOR THE PRODUCTION OF PARTS MADE OF METALLIC POWDERS HAVE BEEN ESTABLISHED AT A NUMBER OF ORGANIZATIONS. AMONG THEM IS ONE OF THE SHOPS OF THE ARMELEKTROMASH PRODUCTION ASSOCIATION, THE FIRSTLING OF POWDER METALLURGY IN THE REPUBLIC, WHICH PRODUCES PARTS OF ELECTRIC MACHINES. It is possible to show their efficiency on the basis of the example of a slip ring made of copper. Its plant cost with respect to traditional technology comes to 5 rubles 28 kopecks, with respect to powder technology--3 rubles 10 kopecks.

LARGE SECTIONS HAVE BEEN ORGANIZED AT THE ARMSTANOK SCIENTIFIC PRODUCTION ASSOCIATION AND THE ARMNIPROTSVETMET, AT WHICH TECHNOLOGICAL DEVELOPMENTS ARE BEING ASSIMILATED AND THE PRODUCTION OF ITEMS IN VOLUMES OF TRIAL DELIVERIES IS BEING CARRIED OUT.

SECTIONS FOR THE PRODUCTION OF PARTS FOR SPINNING AND WEAVING MACHINES AND ELECTRONIC INSTRUMENTS ARE OPERATING SUCCESSFULLY IN THE SYSTEM OF THE REPUBLIC MINISTRY OF LIGHT INDUSTRY AND AT THE SCIENTIFIC RESEARCH INSTITUTE OF MATHEMATICAL MACHINES.

LABORATORIES AND DEPARTMENTS HAVE BEEN ESTABLISHED AT THE ARMELEKTRODVIGATEL, ARMELEKTROMASH, AND ARMSTANOK SCIENTIFIC PRODUCTION ASSOCIATIONS, AS WELL AS

AT THE ARMNIPROTSVETMET, THE INSTITUTE OF CHEMICAL PHYSICS OF THE ARMENIAN SSR ACADEMY OF SCIENCES, THE SPECIAL DESIGN AND TECHNOLOGICAL BUREAU OF THE ARMENIAN SSR MINISTRY OF LIGHT INDUSTRY, AND THE NITIM SCIENTIFIC PRODUCTION ASSOCIATION.

Yerevan Polytechnical Institute has become the leading scientific organization in the area of powder metallurgy in the republic. Within it are the Chair of the Technology of Construction Materials and the Problem Laboratory of Powder Metallurgy and Coatings. In addition to scientific coordinating activity Yerevan Polytechnical Institute is conducting long-range research, which is aimed at the development and introduction of new construction materials and items.

Unfortunately, scientific research is at a significant distance from practical implementation. The reason for this is not only the difficulties of assimilation or the backwardness of some production managers. The inordinate passion for research and the global nature of the themes themselves, which are characteristic, for example, of the sectorial institute of Armstanok, do not always yield positive results. It is no secret that the machine tool parts, which are being produced at present, are mainly being made from the simplest composites and, moreover, in negligible volumes. Meanwhile it is possible to use successfully the developments of the Institute of Problems of Material Science of the Ukrainian SSR Academy of Sciences and other organizations, without spending in so doing considerable state capital.

The Institute of Chemical Physics of the Armenian SSR Academy of Sciences, including the special design and technological bureau, have to solve important problems. It is a question of the expansion of the production of powders of refractory compounds and their efficient use. FIRST OF ALL FOR THE RECONDITIONING (BY SURFACING) OF WORN OUT PARTS OF MACHINES OR THEIR HARDENING (BY SPRAYING), ESPECIALLY FOR AGRICULTURAL EQUIPMENT. Enthusiasm does not always conquer here.

The institute developed an original process of obtaining hydrides of metals, which are so necessary for modern equipment, but cannot implement it only on its own. THE MANY YEARS OF WORK, ON WHICH LARGE SUMS OF CAPITAL HAVE BEEN SPENT, ARE COLLECTING DUST ON THE SHELF....

One has also to marvel at the fact that individual managers of enterprises are succeeding in brushing aside powder metallurgy, although ORDERS OF UNION MINISTRIES FOR THE ESTABLISHMENT OF SUCH WORKS EXIST. The five-year plan has ended, but nothing was done in this direction either at the Spitak Elevator Building Plant or at the Yerevan Avtoagregat Plant.

An urgent problem is the supply of engineering personnel in the specialty "Powder Metallurgy and Composite Materials."

Concerning the prospects of the development of powder metallurgy in the republic for 1986-1990 and the period to 2000, it seems necessary to implement the following measures:

TO ESTABLISH THE RANGE OF ITEMS, WHICH ARE BEING CONVERTED TO THE TECHNOLOGY OF POWDER METALLURGY, WITH A TECHNICAL AND ECONOMIC SUBSTANTIATION; TO UNITE THE SUBDIVISIONS OF THE CHEMICAL AND METALLURGICAL TYPE OF THE SYSTEM OF THE REPUBLIC ACADEMY OF SCIENCES INTO A LARGE SCIENTIFIC ORGANIZATION, FOR EXAMPLE, INTO "THE INSTITUTE OF METALS AND ALLOYS," HAVING MADE THE TECHNOLOGY OF POWDER METALLURGY AND COATINGS THE BASIS FOR ITS ACTIVITY; at Yerevan Polytechnical Institute TO INAUGURATE THE SPECIALTY IN THE TRAINING OF ENGINEERING PERSONNEL IN POWDER METALLURGY AND COATINGS.

It is advisable to carry out integration FOR THE PURPOSE OF THE ESTABLISHMENT OF A REGIONAL INTERSECTORIAL WORKS (IN MUCH THE SAME WAY AS THE BELORUSSIAN SCIENTIFIC PRODUCTION ASSOCIATION WHICH IS SUBORDINATE TO THE REPUBLIC COUNCIL OF MINISTERS). THERE IS ALSO ANOTHER SOLUTION: HIGHER EDUCATIONAL INSTITUTIONS, which have gained work experience in the area of powder metallurgy, COULD BECOME the base for regional cost accounting scientific production associations.

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## AWARDS AND PRIZES

### LOMONOSOV GOLD MEDALS TO MEXICAN, SOVIET GEOLOGISTS

Moscow PRAVDA in Russian 6 Feb 86 p 2

[Article: "The M.V. Lomonosov Medals"; first two paragraphs are PRAVDA introduction"]

[Text] The Presidium of the USSR Academy of Sciences has awarded the M.V. Lomonosov Gold Medals for 1985 to Academician M.A. Sadovskiy for outstanding achievements in the field of geophysics and geology and to Professor G. Aro (Mexico) for outstanding achievements in the field of astrophysics.

The M.V. Lomonosov Gold Medals are the highest award of the USSR Academy of Sciences and are awarded annually (one to Soviet scientists, one to foreign scientists) for outstanding achievements in the field of the natural sciences.

Academician Mikhail Aleksandrovich Sadovskiy is an outstanding Soviet scientist and is well known for his basic research in explosion physics and shot seismic surveying, which has enriched domestic and world science.

Profound, basic results were obtained by M.A. Sadovskiy in the works devoted to questions of the theory of explosion, including the substantiation of the law of similarity in case of explosions, as well as in the use of the mechanical and seismic effects of large explosions. Numerous works of M.A. Sadovskiy in explosion physics and shot seismic surveying found important national economic application, particularly when elaborating norms of seismic safety in mining construction and in the use of large directed explosion in constructing the largest hydraulic engineering structures of the country.

For more than a quarter century M.A. Sadovskiy has been in charge of the Institute of Earth Physics imeni O.Yu. Shmidt of the USSR Academy of Sciences, the most important domestic geophysics institute. During these years new basic directions in geophysics: the physics of the focus of earthquakes, computer geophysics, the study of the matter of the depths of the earth, have been established and are being successfully developed under the supervision and with the direct participation of M.A. Sadovskiy. In recent years a new model of the geophysical environment has been developed on the initiative of M.A. Sadovskiy, which is fundamental for the solution of applied problems of geophysics.

The studies of the problems of the forecasting of earthquakes and the evaluation of the seismic danger, which are headed by M.A. Sadovskiy and during which practical methods of long-range forecasting have been elaborated and maps of the breakdown of the territory of the USSR into seismic regions, which support seismic resistant construction, have been developed, are of great state and scientific importance.

Academician M.A. Sadovskiy is the recognized founder and head of the Soviet school in explosion physics. A versatile scientist and the author of more than 100 scientific publications, M.A. Sadovskiy has much experience in the supervision and training of scientists.

The outstanding scientific services of M.A. Sadovskiy and his significant contribution to the development of international cooperation in the problems of geophysics and geology have received international recognition. He was elected a foreign member of the GDR Academy of Sciences and has been awarded medals of a number of foreign academies.

The great and fruitful activity of Academician M.A. Sadovskiy has been commended by lofty state awards of the USSR. Academician M.A. Sadovskiy is a Hero of Socialist Labor and the winner of the Lenin Prize and four USSR State Prizes.

Professor Guillermo Aro is a prominent Mexican scientist and the founder of modern Mexican astronomy. He is the author of important works in a number of directions in the field of astrophysics.

Professor G. Aro has made an outstanding contribution to the study of the problems which are connected with the earliest stages of the evolution of stars. The young formations, which were discovered by G. Aro, are unusual in their nature, and later received the name of Herbig-Aro objects, are of great scientific importance.

The discovery of the first flare stars in young star systems, which are one of the youngest periods of the development of dwarf stars, is connected with the name of G. Aro. Subsequently hundreds of flare stars were discovered under the supervision of G. Aro, which contributed to the establishment of the evolutionary status of young star systems.

A series of works on the observation of planetary nebulae, which led to a change of the formed notions about the prevalence of these objects, holds an important place in the research of G. Aro.

The discoveries, which were made by G. Aro during the study of weak blue stellate objects and especially blue galaxies, are of outstanding importance for the development of modern astrophysics and the extension of the knowledge about extragalactical regions. These works of G. Aro marked the beginning of systematic studies of galaxies with active nuclei throughout the world.

The scientific activity of G. Aro is connected with work at the largest telescopes of national observatories, including in Tonantsintla and San Pedro.



For more than 10 years G. Aro was in charge of the National Institute of Astrophysics, Optics, and Electronics in Tonantsintla, which was established on his initiative. At present G. Aro is a staff member of the Institute of Astronomy of the National Autonomous University of Mexico.

Professor G. Aro has published more than 70 works, many of which were the basis for the most topical trends of modern astrophysics.

The basic scientific achievements of G. Aro have been widely recognized by the world scientific community. He has been elected an honorary doctor of several universities and for a number of years (1961-1967) was the first of the Latin American astronomers to be vice president of the International Astronomical Union.

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## GENERAL

### BETTER USE OF HIGHER EDUCATIONAL INSTITUTIONS' POTENTIAL

Moscow SOVETSKAYA ROSSIYA in Russian 4 Jan 86 p 1

[Article by RSFSR Minister of Higher and Secondary Specialized Education Academician I. Obraztsov under the rubric "The Opinion of a Specialist": "The Scientific Arsenal of the Higher Educational Institution"]

[Text] We will read carefully once again the laconic lines of the pregress documents, which our party has submitted for national discussion. Behind them is a program of the cardinal acceleration of scientific and technical progress and the qualitative transformation of all our life, which, let us say frankly, is unprecedented in its scale. All of us already today have much to reconsider and much to learn all over again. Such is the logic of progress. Time requires of each of us competence, a sense of the new, boldness, and the willingness to assume responsibility.

I believe that it is clear to everyone: a special, key role is being assigned in the new five-year plan to science and technology. "The fundamental task," it is noted in the draft of the Basic Directions, "is to strengthen the relations of science and production, to develop such organizational forms of the integration of science, technology, and production, which make it possible to ensure the efficient and rapid passage of scientific ideas from conception to extensive use in practice. To increase the responsibility of scientific organizations for the level of research and development and for their most complete use."

What is hindering today the efficient scientific service of production and the rapid introduction of the results of research?

In my opinion, first of all one should speak about the fact that production itself in recent decades to a significant extent has been deprived of scientific service. In many respects this occurred because the sectorial and plant pilot experimental base, instead of assimilating and turning over to production the developments of the basic and applied sciences, worked for the most part for the gross, and not for experimental research. As a result the expenditures on the introduction of scientific achievements in the past 5 years decreased in a number of sectors of machine building. And in 1986 for

11 sectors of machine building they will come to only 2.6 billion rubles. This is several fold less than, in the opinion of specialists, is required for the fundamental updating of the economy.

Given the low level of expenditures on science at the main sectorial scientific research institutes mainly only current, "hot" issues are being worked on and important long-range problems are being neglected. Hence the low efficiency of research in the sectors of machine building and the low technical level of many items. Is it worth being amazed at the fact that only 44.6 percent of the total output of products, which the machine building sectors are also planning to produce for 1986, will be products of the highest quality category, while export deliveries will amount to even less-- 5.3 percent. In order to correct these shortcomings, it is necessary to increase the material investments in the introduction of scientific and technical achievements by at least 2.5- to 3-fold.

I foresee a possible reproach: it is easiest of all, they say, to seek the key to the solution of one problem or another in the increase of financing. I will reply as follows: in this case it is a question not so much of additional assets as of the elimination of the disproportion in the financing of basic and applied research and experimental design development. There are many controversial factors here. Scientists have been debating about this for more than a decade. However, for the present no specific analysis, no reliable forecast, and no sensible suggestions exist. I am confident: such work would be within the power of the higher school jointly with sectorial and academic science. Indeed, the majority of higher educational institutions have established long-term relations with enterprises and are carrying out for them both the training of personnel and scientific research. It is an entirely feasible task for higher educational institutions, at which specialists of practically all scientific directions have been gathered, to make on a statewide scale an analysis of the state of the pilot experimental base of sectors, to obtain a forecast, and to give sound recommendations for sectorial ministries on the improvement of the state of affairs. Moreover, in our country a mechanism has been developed and good experience exists in the formation of temporary scientific collectives for the fulfillment of special-purpose programs, moreover, ones made up of representatives of various departments.

The tasks of science of the higher educational institution are clearly formulated in the draft of the Basic Directions. This is, first, to concentrate the potential of the higher school on the solution of the most important scientific and technical problems. And, second, to introduce the developments of the higher educational institution in production, so to speak, on its own, that is, to turn them over to plants together with specialists. We have already been able to do something in this respect. In 1980 a cost accounting scientific association (KhNO) of the RSFSR Ministry of Higher and Secondary Specialized Education was established as an experiment. Owing to it we are now conducting the bulk of research and development of the higher educational institution on the basis of the goal program method and supply orders and have ensured the unity of the educational and scientific process on the basis of the principles of the special-purpose training of specialists for

the accompanying of the developments of the higher educational institution with personnel.

However, it is no secret: at the majority of higher educational institutions the pilot experimental base is still very weak. It is natural that many developments of the higher educational institution, not having received adequate design and technological substantiation, do not reach the stage of industrial introduction. For example, the cost accounting scientific association offered to industry for 1986 more than 300 highly efficient innovations which had been checked in practice. An economic impact of 1.5 billion rubles is expected just from the introduction of 70 developments on which agreement has been reached with sectors. But the remaining 230 developments, which have been brought up to prototypes, so far have not found their own client and have not been included in the national economic plans. There is another example. At the higher educational institutions of the ministry several tens of important computer-aided design systems and automated systems of scientific research (SAPR, ASNI) have been readied for extensive industrial assimilation in the sectors of machine building. They are being introduced extremely slowly.

The acceleration of scientific and technical progress is inconceivable without the reorganization of the process of instruction at the higher school. In this I, as the minister, completely agree with and support the article of V. Sokolov, rector of Krasnoyarsk University, which was published in SOVETSKAYA ROSSIYA ("The Higher School: Reorganization Is Required," 29 November 1985). In order not to repeat many conclusions and assumptions from his article, I will say that today, as never before, we need highly skilled engineering personnel, who are able to use new automated means of labor and are capable of implementing rapidly revolutionary ideas and fundamentally new items and technologies. It is also necessary to train the new personnel in a new way. Last year an experiment on the special-purpose intensive training of specialists was begun at 34 higher educational institutions of our ministry. The essence of the experiment consists in the fact that the higher educational institution beginning already with the first year trains a specific specialist for a specific enterprise. The instruction has the aim that the future engineer would be capable of posing and solving long-range problems of the retooling of sectors and the output of products which correspond to the world level. Flexible curricula, in which such new subjects as computer-aided design systems (SAPR), flexible machine systems (GAP), automated data banks and banks of knowledge, the mathematical modeling of physical chemical and socioeconomic processes, the methods of creative scientific and technical work, systems analysis, and the organization and management of the collective have been introduced, have been developed. Emphasis has been placed on intensive methods of instruction on the basis of automated teaching systems, business games....

During the current five-year plan it is envisaged to train more than 35,000 specialists of the new type for the sectors of machine building. Their assignment is being planned in the form of creative "landing party" groups. The cost of the training of one specialist through the new system of instruction is increasing by several fold and comes to more than 30,000 rubles. So the higher educational institution can undertake it only on

a cooperative and cost accounting basis with industrial enterprises and on the basis of direct contracts with the client. The special-purpose intensive training of specialists of the new type, as the first steps of the experiment are already showing, can be carried out most successfully at interdepartmental scientific and technical complexes and educational scientific production centers, the establishment of which is spoken about in the draft of the Basic Directions. This is another argument in favor of the quickest elimination of the departmental isolation between research institutes, higher educational institutions, and production.

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CSO: 1814/161

GENERAL

NEW PAY TERMS DEEMPHASIZE DEGREE, EMPHASIZE EFFICIENCY

Moscow LITERATURNAYA GAZETA in Russian 15 Jan 86 p 12

[Interview with Valentin Dmitriyevich Kharin, chief of the Scientific, Construction, and Design Organizations Department of the USSR State Committee for Labor and Social Problems, by LITERATURNAYA GAZETA correspondent S. Ushakov: "Not for the Degree, But for Labor"; date, place, and occasion not given; first two paragraphs are LITERATURNAYA GAZETA introduction]

[Text] To change radically the existing structure of the system of the material stimulation of the labor of scientists, designers, and process engineers--such a task is formulated in the decree of the CPSU Central Committee, the USSR Council of Ministers, and the All-Union Central Council of Trade Unions. The stage of the extensive use of the developed organizational measures is beginning this year. It is expected that the new system of remuneration should increase sharply the interest of scientists in the final product of their labor, interrupt the high-paid "drowsiness" of those holders of academic degrees, who long ago lost their creative potential, and facilitate the promotion of talented young people.

This is discussed in the interview of a LITERATURNAYA GAZETA correspondent with V.D. Kharin, chief of the Scientific, Construction, and Design Organizations Department of the USSR State Committee for Labor and Social Problems.

[Question] Valentin Dmitriyevich, how broad is the group of workers, whom the new system of remuneration will affect?

[Answer] According to our estimates, this is more than half of all the scientists of the country and nearly 90 percent of the designers and process engineers. The coverage of staff members of the USSR Academy of Sciences and the academies of the union republics will be 100 percent.

[Question] What is the essence of the new principle of the remuneration of labor?

[Answer] First of all the rejection of the rigid dependence of the wage on the length of scientific teaching work and the having of an academic degree, which has been criticized so many times by the scientific community and the

press, including LITERATURNAYA GAZETA. It cannot be said that in the new system the academic degree will not be taken into account at all, but it will become only one of a number of decisive factors. If such a comparison is permissible, I would liken the degree to the certificate of an actor: it gives the right to appear on the stage, but what place the actor will hold in the theater, whether he will remain in the mass of extras, or will play the lead role--this will be determined by his real creative potentials. The wage of a scientist with and without a degree will now depend more on the results of his labor, on the effectiveness of the research being conducted by him, on its scientific and national economic importance, on the contribution to the matter of introducing his own developments.

For the achievement of these goals the spectrum of positions of scientists and the range of salaries are being broadened significantly. Thus, at scientific institutions of the first category this range will come to 140-450 rubles a month. Five positions fit into it: junior scientific associate, scientific associate, senior, leading, and chief scientific associates. The senior scientific associate is the person who is made responsible for the scientific supervision of a group of associates when conducting research, or he should perform difficult operations independently. An academic degree is mandatory only for leading and chief scientific associates: a candidate or doctor of sciences can be a leading associate, while only a doctor can be a chief associate. The elimination of the "degree qualification" from more than half of the levels of this hierarchy will facilitate the attraction to science of talented engineers from production: in the position of a senior scientific associate a person without a degree can now expect a salary of up to 350 rubles. Previously a salary of 190 rubles was the "ceiling" of such a specialist.

[Question] But who will determine the amount of the salary and the position of an associate? The board of directors?

[Answer] The new system frees the hands of the manager of the institution. Without being obliged now to link the salary with the having of a degree and the length of scientific work, he can settle without difficulty both the question of the promotion of a specialist, who works productively, and the question of the demotion of an associate, who is coping poorly with his duties. The same thing also applies to changes of the salary within one position. Moreover, the transfers "downward" are in no way limited: a chief scientific associate, who has "dozed off" in his responsible and highly paid position, can be transferred even to the position of a junior scientific associate. If due to such a shock his creative "sleep" ceases, nothing will prevent him subsequently from again reaching the heights of the scientific hierarchy.

[Question] Does the danger of the subjectivism of the director not exist here?

[Answer] In order to eliminate the lack of objectivity of decisions, the opinion of the scientific collective should be taken into account. The existing mechanism of certification will be used when changing the position of a worker or his salary. The director has the right also to make himself the



decision on a transfer "upward," but a demotion or reduction of the salary can be made only in accordance with the results of the certification. It should be carried out no less often than once every 5 years, if the administration and public organizations of the institute decide to carry them out more often, please do.

[Question] I want to remind you of the article of Professor A. Kitaygorodskiy "Is It Fruitful? It Is Profitable!" in LITERATURNAYA GAZETA of 24 July 1985. The author told about the mechanisms of the evaluation of the skills of a scientist in different countries. In several of them an extensive survey of colleagues, including foreign colleagues, is simply made. Is intra-institute certification not too narrow, is it not secret?

[Answer] Indeed, you often hear from the opponents of the new system that the former objective indicators--the length of service and the degree--are now being replaced by a subjective evaluation. This is not so, although it is impossible to develop immediately an absolutely objective and effective method of evaluation: it will emerge gradually, as a result of successive approximations of the ideal. The question of involving the scientific community at large in the procedure of evaluating a scientist merits attention, but this applies mainly to the basic sciences. As to applied research, its results, as a rule, are quite obvious: the elaborated design documents, the systems and technological processes, which have been introduced in industry, and so on.

The Scientific Research Institute of Labor attached to the USSR State Committee for Labor and Social Problems has prepared a draft of recommendations on the evaluation of the activity of workers of science. The novelty and significance (scientific, national economic) of the development being performed, the economic efficiency, the absence of errors in the prepared documents, the extent of the introduction of the results in practice, and so on are recognized as the main criteria. Means of approximate quantitative evaluation with respect to each of the criteria are proposed.

[Question] And in this set of indicators will the academic degree not have any weight, at least at the first three levels of the scientific hierarchy?

[Answer] Why! Any associate with the awarding to him of an academic degree has the right to demand from the administration an increase of the wage within the limits of the salary "spread" or a transfer to a higher position. The degree will give preference to the holding of a position (in case of several candidates). Only the automatic wage increase "for an academic degree" disappears. Moreover, it will be possible to place loafers, regardless of their titles and length of service, in a position which corresponds to their real productivity.

[Question] But in life the "everything higher, and higher, and higher" of song is not always possible. After a period of intense work at times a certain "recreation" fallout is necessary. Will this really be accompanied by jumps from position to position?

[Answer] In order to avert such jumps, another unusual mechanism is envisaged: a set of salary increments for the fulfillment of the most difficult and responsible jobs (for the time of the performance of such a job, but, as a rule, not more than a year). For scientists, designers, and process engineers such an increment can amount to half of the salary, for other categories of personnel--30 percent. A young talented experienced scientist, who has come to a scientific research institute of the first category from production, in case of intensive and highly efficient work will be able to earn up to 525 rubles a month. The monetary obstacle, which held in check the influx to the scientific research institute of talented production workers who are capable of solving within the walls of the institute important and urgent problems, will disappear. Such an increment will also become a substantial stimulus for scientists who have been working for a long time at the institute. They will receive it, if during some period they begin to perform work of a higher level than the held position requires. Of course, whoever is capable of constantly maintaining this high level, can simply be promoted up the ladder of positions.

However, I stress that the salary increment can be granted only for the fulfillment of a specific research job, and not for high skills in general. Therefore, no one will receive such an increment simply for the supervision of operations.

[Question] Does it turn out that the young production worker, who has come to the institute, at times will begin to earn more than the director? Will not a high wage give rise to the intensive "jumping" of specialists from industry to scientific research institutes?

[Answer] The wage should be governed by the results of labor, one should not be astonished at this and should not introduce artificial restrictions like "no higher than the Capitol." As to the "jumping" of people from industry to science, this flow will be equalized by reverse transfers. Any scientist, who has accumulated the appropriate theoretical reserve, will now be able to transfer to a job in industry--to introduce his own achievements, without losing the wage and without giving up his status as a scientist. For a period of up to 1 year his place at the scientific research institute can be kept for him. At the new place of work he will begin to receive his former average salary plus possible bonuses for the successful implementation of scientific ideas. After a year he can return to the institute, but can also remain at the works--for the system of the remuneration of the labor of scientists will now be uniform in science and in industry. Moreover, the specialist will be able to work at the works through the combining of jobs--as a consultant.

[Question] But from where should scientific institutions derive the additional monetary assets in order to increase so appreciably the wages of their associates?

[Answer] There will be no additional allocations for the wage. Not a kopeck. That is just the point of the new system, that it is necessary to redistribute wisely the already available fund, to get rid of all loafers, and to put the freed assets into increasing the wages of those personnel who actually work efficiently. The decrease of the number of associates--we believe that as a

whole, with allowance made for the available vacancies, it will come to approximately 6-10 percent--is entirely inevitable, even if there are no obvious loafers: simply the least productive portion of the personnel should leave, so that the additional money obtained this way could be used for the stimulation of the labor of people who work more efficiently. Of course, here the use of working time will improve sharply, more productive labor techniques will become necessary, and so on.

At the first stage some difficulties with the job placement of the freed personnel are inevitable. Although under the conditions of the Leningrad experiment, during which the new system was tested, everything proceeded comparatively smoothly: at the large scientific production associations a shortage of shop personnel was observed, so the design bureaus transferred the surplus associates to the shops. It will be more difficult in other regions of the country, where manpower is not so scarce, but, we believe, in a year or two the problems will be solved. The main thing is to carry out the reform of the system of remuneration not formally, but by having linked these measures with the assurance of the overall acceleration of scientific and technical progress of the country.

[Question] Will the "supercompact packing" of staffs, which has been achieved in this way, not make difficult the movement of young people into science? Will a young person be able to squeeze his way into this conglomerate of middle-aged specialists, who have been selected more than once and are already very firmly established in their places?

[Answer] In order to facilitate for young people entry into science, it is necessary to create a certain reserve of workplaces--especially for young scientists and graduates of higher educational institutions. Some additional decrease of those working now will be required for this. The decision on such a reduction has already been made by a large number of ministries and departments. Such a means was also used during the above-mentioned Leningrad experiment.

Incidentally, this is not the only means of the planned updating of the staff of a scientific institute or a design and technological bureau. The former mechanism of the hiring of specialists from outside through competition--for a vacancy--is being retained. You ask: From where are there vacancies in the already established collective? The natural freeing of workplaces at scientific institutions comes to about 5 percent a year: someone transferred to another job, someone moved to another city, that one enrolled in graduate studies, this one was admitted to a higher educational institution.... That is, on the average in 20 years the composition of personnel becomes completely new. Here is the constant appearance of vacancies for you.

Moreover, the new system of remuneration implies--and this is very essential!--the existence at all scientific institutions of a permanent reserve made up of unfilled staff units. The director, who has spent recklessly all the assets for the wage fund, which have been allocated to the institute, henceforth is a poor manager. But so that the manager would not fear that at the end of the year they will "trim" his fund, according to the new procedure the money saved on the wage can be left at the disposal of the

institute--can be put into the material incentive fund of the personnel. This emphasizes once again the basic direction of the changes being introduced: to perform work with a smaller number of associates, while giving them the opportunity to work more and better and in so doing to earn more.

[Question] Such promising changes should, apparently, evoke enthusiasm among the specialists working in science and in industry....

[Answer] To be an optimist does not mean to look at the world through rose-colored glasses. The steps being taken will undoubtedly evoke enthusiasm, but only among those who work and want to work well. Those who are accustomed to spending time sitting on the job, working half-heartedly, will have to change their habits--or give up their place to others. They will hardly do this with enthusiasm.

The new system will also add to the worries of managers of all levels. While giving them unusually broad rights, at the same time it will require of them constant initiative, persistence, and the skillful and competent exercise of these rights.

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CSO: 1814/161

## GENERAL

### IMPROVEMENT OF WAGE, FINANCIAL, PERSONNEL POLICY IN SCIENCE

Moscow EKONOMICHESKAYA GAZETA in Russian No 7, Feb 86 p 10

[Article by Academician of the All-Union Academy of Agricultural Sciences imeni V.I. Lenin G. Muromtsev, director of the All-Union Scientific Research Institute of Applied Molecular Biology and Genetics of the All-Union Academy of Agricultural Sciences imeni V.I. Lenin (Moscow): "Science: The Reserves of Efficiency"; passages in all capitals appear in boldface in original]

[Text] Today one scientist of the world in four works in the USSR. This is an enormous potential. And it is clear that it is necessary to use it with a much greater return than before. There are no doubts that the extensive means of the development of science, just as of other spheres of the national economy, has become obsolete. The sharp increase of the efficiency of science as the base unit of scientific and technical progress is necessary. The June (1985) conference in the CPSU Central Committee on questions of the acceleration of scientific and technical progress, in which I had occasion to be a participant, aimed us precisely at this.

I would like to share several views on what for the present is still hindering such reform.

#### REMUNERATION ACCORDING TO THE END RESULT

It is generally acknowledged that remuneration according to the end result is a necessary condition of the increase of production efficiency. How do matters stand with reference to science?

Let us take the state of affairs in invention. Two aspects of the problem emerge here. First, how to increase the stimulation of invention and to speed up the introduction of highly efficient developments. Second, questions of the protection of the claims of Soviet citizens abroad.

The efficiency of invention in many ways depends on remuneration according to the end result. An invention (a new compound, instrument, machine, technology) is not an end in itself. This is a means of increasing labor productivity in the sectors of the national economy. The end result of an invention also consists in this. And, hence, its remuneration should also be

carried out precisely according to the national economic impact from the invention.

Today the situation is not at all that way. The material stimulation of invention has been made directly dependent on the volume of the product produced in accordance with the invention and in practice does not depend on the actual impact which this product gives the national economy. As a result a paradoxical situation is forming: developers are materially interested in the output of low-activity compounds and low-performance equipment and in seeing to it that their creation would be more expensive, and not less expensive. For a lot of a low-activity compound and a little of a high-activity compound are needed, many low-performance machines and few high-performance machines are needed.

The existing practice of the material stimulation of invention has become an obstacle in the way of the development and production of highly efficient compounds, instruments, machines, and technologies and is hindering the introduction of such developments. This is having an especially unhealthy effect on the production of low-tonnage products with a small "gross"--biologically active compounds, catalysts, enzymes, and like products, which are being produced more and more extensively by the biotechnological sectors.

Thus, the prevailing system of the remuneration of invention is fundamentally incorrect, since the notorious "gross," and not the actual national economic efficiency of the invention is the basis for it. One of the causes of the operation in the national economy of expensive and inefficient technologies and equipment and of the thorns, through which highly efficient and economical innovations often have to "force their way," lies in it.

As to the second aspect of the problem, existing legislation hinders the protection of the priority of Soviet developments abroad. The point is that the inclusion of the given development in a plan of introduction is a mandatory condition of patenting abroad. But since the "pushing through" of the introduction of new technologies and compounds is very difficult for the authors, this frequently upsets both patenting itself and the possibility of the profitable sale of licenses.

Another negative thing is the stand of the workers of the All-Union Scientific Research Institute of State Patent Examination of the USSR State Committee for Inventions and Discoveries when examining applications. The pronounced aspiration first of all to refuse to issue an inventor's certificate characterizes it. It seems that from the standpoint of state interests it should be the other way round. The workers of the State Committee for Inventions and Discoveries should literally find everything new and valuable in domestic science and technology, in order to reliably protect the priority of our country.

This situation, in our opinion, is explained by the fact that the All-Union Scientific Research Institute of State Patent Examination is not physically capable of ensuring the qualified examination of the enormous flow of applications for inventions. Moreover, the issuing of an inventor's certificate, which follows a rejection, apparently, is regarded as a flaw in



the work of the expert and can entail specific sanctions. Often this forces experts to insist on their rejection even given its obvious untenability. It is necessary to settle these questions, and to settle them without delay.

There is another remark. The scale of the use of an invention and, consequently, its national economic return, as a rule, increases with the years. However, from a material standpoint for the inventor this is no longer of any importance--payment is made only for 5 years from the start of introduction. In this respect the representatives of other spheres of creative activity--literature and art--are under incomparably more favorable conditions. If we compare, say, the share of the remuneration of the labor of a popular actor and a scientist-inventor in the income which they have brought to the country, the difference will be stunning.

We are also very far from observing the principle of remuneration according to the end result in the sphere of the training of scientists. Today the basic means of training scientists of the highest skill in our country is graduate studies. The work on a candidate dissertation is a good school of the formation of the scientist. The leading figure in this process is the scientific supervisor, who selects the graduate student and works with him daily.

How is his remuneration carried out? Monthly from the first to the last day of graduate studies for the supervision of a graduate student the scientific supervisor receives a negligible amount--less than 20 rubles.

The end result of the 3 years of training of a graduate student is specified quite clearly--the successful defense of the candidate dissertation. But the remuneration of the scientific supervisor is in no way connected with this end result. It is carried out regardless of whether or not the graduate student prepares and defends a dissertation. Therefore, the scientific supervisor is interested materially only in recruiting a few more graduate students. In the 1930's, when the country was experiencing an acute shortage of scientists, such a system was probably justified. Now it is possible rather to speak about the overproduction of scientists to the detriment of their quality. I believe that the sad statistic--probably less than half of the graduate students defend on time--is connected not last of all with this circumstance.

Meanwhile it is quite easy to make the remuneration of the labor of the scientific supervisor directly dependent on the end result. For this it is necessary not to credit to him a monthly reward for having a graduate student, but to make a one-time payment after the successful defense of the dissertation and its approval in the Higher Certification Commission.

As a result the scientist will cease to strive to recruit many graduate students: you will not train everyone properly, he will personally seek the most capable ones and will devote more time and effort to them. There will probably be fewer graduate students, but this is also not bad. In science, as nowhere else, the principle--better is fewer and better--is important.



## FINANCES AND STAFF

The opinion exists that two or three technical personnel are needed per scientist. Their purpose is the washing of laboratory glassware, sterilization, the "filling" of pots with soil, and the like depending on the specialization of the institute. Even a norm of this ratio--not less than one to two--has been established legislatively, while some managers advocate even one to four. Here they frequently cite foreign experience--they have, they say, precisely such a ratio.

It is surprising that in this case science itself is ignoring the general trend of scientific and technical progress--the elimination of routine manual labor, its maximum mechanization, and accordingly the decrease of the proportion of personnel engaged in it. But abroad Petri dishes, for example, are supplied already sterile--for one-time use, test tubes are provided with durable stoppers. We, just as half a century ago, plug test tubes with cotton stoppers, which we "roll" by hand, we wash, roll, and sterilize glass Petri dishes by hand. Of course, it is a sacrilege to charge scientific associates with such work.

But what about the foreign experience with respect to the "ratio"? Here it is simply an obvious misunderstanding. The point is that in our country they regard a much broader stratum of specialists to be scientists than abroad (and call an even broader one engineers). But this is due to the fact that the wage of a highly skilled technical specialist is too little. Thus, the lack of conformity to world practice here is an apparent one. But the existing aim of 1:2 is pulling us back--to unproductive manual labor. The USSR State Committee for Science and Technology and the USSR State Committee for Labor and Social Problems should carefully examine this important question.

And there is another remark. In recent years the reduction of the staffs at scientific research institutes has been carried out systematically. This measure is necessary. It does not arouse anyone's doubt that we have a little too many personnel of science, just as, incidentally, so-called engineers. But in the solution of this problem one must probably not take the easy path--"for all the sisters a set of earrings each," but it is necessary to close more boldly obsolete directions, unnecessary subdivisions, as well as entire scientific research institutes and their affiliates. But how is it now--they open a new, apparently, very necessary, institute, but already the next year "send down" to it a staff reduction.

As the director of an institute, I feel all the time the urgent shortage of personnel and make requests on the expansion of the staff. At the same time we clearly see at our institute large hidden reserves. I will explain with examples. At present we are keeping watchmen primarily for duty at night and on days off. Many young associates of the institute would willingly perform these duties for a moderate additional payment. But instead of watchmen we would hire highly skilled specialists. But it is not allowed: it is a gross violation of staff and financial discipline.

In each laboratory we keep a so-called economic laboratory worker, most often at the rate of an engineer. He has little to do, but this is a materially

responsible person. No one wants to assume his duties "as a voluntary service." But many would for an additional payment. Technical personnel are often not kept fully occupied. It would be possible instead of two to hire one, paying him extra, of course. Thus, we would in fact manage entirely on our own, but the existing restrictions do not make it possible to do this.

In our opinion, it would be good to start with to extend in part to several scientific research institutes--if only "volunteers"--the new methods of management and to ensure the stabilization of the wage fund with the tolerance of the reduction of the number of personnel and the internal paid combination of jobs.

After all, what, it seems, is simpler: they gave the director X amount of the wage fund, the limit of the size of the staff, but further act as you see it, yet the scientific research institute should work to full effect! But no--we are surrounded on all sides by staff and financial barriers, up to the absurd need to observe the so-called average level of the wage according to the spread, which greatly hinders the attraction of strong personnel. The impression is created that they simply do not trust the directors (party organization, scientific council, the entire collective of the institute).... The experiment, which the Institute of Physical Chemistry imeni Karpov commenced, has now more or less won recognition. But these are half measures. I am convinced that without the cardinal settlement of this question the problem of the intensive development of science will not be solved.

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CSO: 1814/163

## GENERAL

### SUGGESTIONS ON ACCELERATION OF TECHNICAL PROGRESS

Moscow EKONOMICHESKAYA GAZETA in Russian No 7, Feb 86 p 6

[Article by V. Denisov: "Reserves of Technical Progress. A Survey of Letters"; capitalized passages published in boldface]

[Text] During the discussion of the drafts of the CPSU Central Committee for the 27th party congress the problems of scientific and technical progress are arousing special attention and concern of our readers. The authors of the letters--workers and scientists, engineers, veterans of labor--while endorsing and supporting the policy of the party of the acceleration of scientific and technical progress, are making specific proposals which are aimed at the unconditional accomplishment of the posed tasks, are indicating the obstacles which stand in the way of scientific and technical progress, and are seeking means of their elimination.

"It is necessary to commission the State Committee for Science and Technology," Leningrader I. Tsiferblat writes, "to make a complete inventory of the scientific research work which has been completed in the past 10 years. How many fine technical solutions are gathering dust on archive shelves! It is necessary to use them immediately."

It is well known that the process of introducing inventions goes painfully and frequently drags out for long years. In order to put this enormous reserve to use, Muscovite G. Poznyak proposes to improve the economic and legal mechanism so as "to make the practice of management, which is unprofitable for the state, unprofitable for every enterprise and every worker of it." In his opinion, the collective, which first introduced some invention, should receive the status of a production coauthor. Having certified the fact of introduction by the appropriate documents, such an enterprise would have the right for 2 years to allocate the entire amount of the saving from the use of the innovation for its socioeconomic and production needs.

"I propose," G. Poznyak writes, "in the draft of the Basic Directions in Chapter XIV in the section 'Increase the Effectiveness of Economic Levers and Stimuli' after the words 'to increase substantially the role of economic levers in the increase of production efficiency' to add: 'BY THE ASSURANCE OF THE REAL ECONOMIC INTEREST OF ENTERPRISES AND ASSOCIATIONS IN THE INTRODUCTION

OF INVENTIONS AND EFFICIENCY PROPOSALS, INCLUDING BY THE INTRODUCTION OF THE LEGAL STATUS OF THE PRODUCTION COAUTHOR OF THE INVENTION'."

Expressing valid alarm about the quality of scientific developments, M. Kuliyeu, manager of a laboratory of the Institute of Chloro-organic Synthesis of the Azerbaijan SSR Academy of Sciences, sees the cause of many negative phenomena in the lack of technical and economic substantiation of the scientific research work being planned and proposes to establish at the scientific research institute the corresponding subdivisions, which forecast and predetermine the practical importance of the solution of one scientific problem or another.

Developing this idea, V. Mantsov, an engineer-economist from Moscow, proposes to insert in the section "The Acceleration of Scientific and Technical Progress..." of the draft of the new version of the CPSU Program a paragraph of the following content: "IT IS NECESSARY TO IMPROVE THE SYSTEM OF THE COMPREHENSIVE MANAGEMENT OF THE EFFICIENCY OF SCIENTIFIC AND TECHNICAL PROGRESS BY THE IMPROVEMENT OF THE PLANNING, STIMULATION, AND CALCULATION OF THE EFFICIENCY OF NEW EQUIPMENT." Comrade Mantsov also proposes to insert this specification in the draft of the Basic Directions.

Today there is no sector of industry which does not use automation equipment of various purposes. "However," engineer-economist I. Rumyantseva from the Moscow area writes, "the quantitative increase of automated control systems is not always accompanied by their high qualitative level." The integration of plant management automation systems with plant technical management automation systems and computer-aided design systems seems to the author of this letter to be a promising direction. It is proposed to insert the following addition in Section XIV of the draft of the Basic Directions: "TO CONTINUE THE DEVELOPMENT OF AUTOMATED CONTROL SYSTEMS. TO ENSURE THE QUALITATIVE IMPROVEMENT OF OPERATING SYSTEMS AT ALL LEVELS OF THE MANAGEMENT OF THE NATIONAL ECONOMY. TO DEVOTE PARTICULAR ATTENTION TO THE OUTPUT OF PERIPHERAL EQUIPMENT FOR AUTOMATED CONTROL SYSTEMS."

L. Yeregin, chief of the Scientific Research Department of Welding of the Novokramatorsk Machine Building Plant, warns against the "fashion" for technical progress and a formal approach to this important problem. "The development and introduction of advanced equipment, such as flexible machine systems, robots, automation and mechanization in custom and small-series production, as a rule, are proving to be economically unprofitable. The impact cannot be compared with the expenditures. The need has arisen," the author asserts, "for the development of a method of calculating the efficiency of the use of new equipment which increases labor productivity."

The framework of a newspaper survey cannot, of course, contain all the suggestions and wishes of readers on the acceleration of scientific and technical progress, which have been received by the editorial office. But the active civic position of the authors of the letters, their sincere interest in the discussion of urgent problems, and willingness to personally participate in their solution and to be personally responsible for the fate of the future of our country are gratifying and noteworthy.

E. Kogan of Khabarovsk, D. Gabutdinov of Kazan, A. Boguslavskiy of Ufa, A. Pravdin of Petrozavodsk, Yu. Berliner of Moscow, Ye. Ananyev of Odessa, V. and K. Zhudra of Kiev, G. Revzyuk of Leningrad, N. Semichev of Moscow Oblast, V. Spirin of Donetsk, G. Klimenko of Kiev, V. Varentsov of Moscow, I. Koval of Krasnoyarsk, G. Solodov of Irkutsk, and many others also sent in various additions and suggestions for the drafts of the CPSU Central Committee for the 27th Party Congress. All the suggestions of our readers have been sent to the appropriate commissions for study and generalization.

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CSO: 1814/163

## GENERAL

### ANDRIANKIN ON IMPORTANCE, PROBLEMS OF BASIC RESEARCH

Moscow TRUD in Russian 20 Apr 86 p 2

[Article by E. Andriankin, director, Theoretical Problems Department, USSR Academy of Sciences, under the rubric "Today Is Soviet Science Day": "Closer to Practice"]

[Text] The Party Congress with exhaustive clarity stated the need for breakthroughs on the leading avenues of scientific and technological progress. Today, I believe that it is also important to discuss basic research. It is namely in this year that streams of new processes are proposed, which are subsequently investigated experimentally, tested and, finally, placed into production. But, in order to develop problem-oriented theoretical research, from which a practical return can and should be expected, it is necessary to understand the specifics of this activity.

First of all, theory differs from other forms of research in its breadth of generalization. Here original ideas may arise on the boundaries of the most different scientific directions. Other special features of theory are the speed of analysis and flexibility in which research can be restructured.

Yet another special feature of theory is the minimum expenditure of material resources required to work out problems. This aspect is not always assessed to the required degree, and at times miserly savings of funds on unfinished or prematurely halted theoretical projects result in great losses to the economy. On the other hand, haste in the practical use of new physical ideas at times brings losses, which could be avoided through more thorough analysis.

Basic theoretical research is a creative sphere which is more akin to the work of the artist, than that of the engineer. Here the criterion of labor discipline must be the product of the activity itself, irrespective of its time and place (it goes without saying that this does not contradict the need for precise fulfillment of plan targets.) However, many institute leaders still understand discipline as "punching a time clock."

This is largely explained by the lack of a strict criterion for the labor of scientists. We in the Theoretical Problems Department, USSR Academy of Sciences, already 10 years ago introduced and are using an index, which takes into account indices of scientific creativity. It completely justified itself

in assessing the work of the entire collective, but as for the activity of individual workers, this is more complex. Let us assume that it is necessary to assess the work for a year. But, you see, not all years are equal with respect to the number of published articles, reports, defenses of dissertations, and so forth. A so-called concealed, preparatory period exists. Therefore, we never used the index as the basis for organizational conclusions. Otherwise it would have lost its objectivity and, let us say, artificial "multiplication" of articles would have begun. In short, here is a serious reason for reflection.

This, in fact, is all that I wished to say in anticipation of the main issue of the article, which is associated with the interaction of basic science and practice. Here it is important to note that which the prominent mathematician P. Chebyshev very accurately stated: "the drawing together of theory and practice gives the most beneficial results, and not only practice gains from this. The sciences themselves develop under its influence. It opens new subjects for their research ..."

And so, what does industry expect from theory? I have had to ask this question repeatedly to the general designers of major production associations. Almost all their desires boil down to one thing. New physical principles are necessary which support the creation of entirely new machinery and technological processes. In those cases when these principles, based on theoretical premises, were not tested experimentally, the enterprises agreed to carry out such testing themselves. As for the theorists, the desire to implement their ideas is usually their most natural requirement. Why, then is the link with practice in a number of cases still inadequate? This is explained most of all by a number of organizational disorders.

I cannot agree with the desire of some administrators to combine basic science with practice artificially by including theoretical institutes in production associations. This would lead to disqualifying the theorists due to the limited nature of the topic and to turning them into applied scientists.

A promising form of drawing theory and practice together is the creation of interdepartmental scientific brigades for solving comprehensive experimental theoretical problems. In these brigades, which are directed toward the fulfillment of a specific plan target, theorists work together with experimenters, practitioners and applied science specialists. In our department such a brigade was created along with the Institute of Psychiatry imeni Serbskiy two years ago and has very well acquitted itself.

Other types of contacts of basic science with production can also be proposed, but for this it is necessary not only that science switch to the needs of the economy, but also that production turn to science. This was discussed directly at the 27th CPSU Congress. Similarly to the way that the Academy of Sciences is responsible on the scientific methodological plane for industrial NIIs [scientific research institutes] in the field of basic research, it would be appropriate for purely theoretical institutions of the USSR Academy of Sciences and the Ministry of Higher and Secondary Specialized Education to be placed under the responsibility of industrial ministries. It would also be



useful to introduce creative trips by scientists to major factories into the practice of theoretical organizations.

Despite party instructions concerning elevating the role of basic sciences in scientific and technological progress, some departments clearly lack understanding of the importance of theoretic research. To the present this has been allotted a secondary place in state planning targets and this, in turn, prevents theory from having a definite influence on the solution of applied problems, which are frequently posed by theory itself. At times industry takes a biased attitude toward the proposals made by scientists.

Here is a characteristic example. Several years ago a new method for the use of impulse loads was proposed. Industry allocated large sums of money for its implementation but the economic managers, not wishing to follow the paths indicated by the theorists, referred to foreign developments which had long been known to them and were already out-of-date. What happened as a result? After suffering great losses, industry had to return to the proposals made by our scientists.

A most important factor influencing the development of basic research is specialized scientific training. A theorist must be a broadly capable specialist, since the main discoveries occur at the junctures of the sciences.

Solving applied tasks, as a rule, includes the necessity for researching a whole complex of different physical phenomena. For example, the design of a powerful laser requires knowledge not only of quantum optics, but also of magnetic elasticity, acoustics, thermal physics, etc. Broadly knowledgeable scientists -- I. V. Kurchatov, A. P. Aleksandrov, N. N. Semenov, Yu. B. Khariton and others -- took part in working out problems of nuclear energy. Prominent mathematicians and mechanical engineers -- M. V. Keldysh, M. A. Lavrentyev and L. I. Sedov -- headed up work on fundamental new issues of technological development.

However, now a situation has been created when to replace the remarkable constellation of scientists who made a tremendous contribution to the development of not only theoretical, but also technical problems, there have come narrow specialists. These include theorists, who have been divided into radio physics theorists, nuclear theorists, mechanical engineering theorists, etc. This distances scientific research from practice, since such specialists are unable to encompass the many-sided nature of practical problems.

Recently the CPSU Central Committee Politburo discussed the question of improving the country's higher and intermediate specialized education. Today the level of schooling does not fully meet the tasks of accelerating socio-economic development. Strengthening the integration of education, production and science is planned. I believe that the time has also come to devote special attention to the specific training of theorists in high school. Moreover, conditions should be created under which the broad-based specialist, working on the boundary of several scientific disciplines, can obtain well deserved recognition for his labor on an equal basis with narrow specialists (degrees, titles, etc.). Today, in accordance with the

requirements of VAK [High Degree Commission], scientists who integrate several sciences are required to defend their dissertation at a joint session of two soviets, which for various reasons is very difficult to convene. As a result, dissertations which are needed in practice await their defense for years.

A similar situation also exists in elections to the Academy of Sciences. Voting takes place along topical departments. Therefore, specialists who are working at the juncture of different sciences are virtually unable to be considered for election. They are not recognized by any department. I believe that it is necessary to change the system of elections and to allow voting on a single candidature in several departments, taking into account the aggregate average index of votes.

A powerful reserve for movement along the path of progress is found through eliminating the enumerated negative aspects, which retard the development of theory. Scientists engaged in basic research will remember the behest of S. I. Vavilov: "The ability to combine a broad theoretical horizon, general theory and abstraction with a healthy practicality is the best, and nearly the only way for science to help its people."

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CSO: 1814/168

## GENERAL

### BOGOLYUBOV ON MERITS, BENEFITS OF BASIC SCIENCES

Moscow PRAVDA in Russian 25 Mar 86 p 3

[Article by Academician N. Bogolyubov, director, Joint Institute of Nuclear Research, two-time Hero of Socialist Labor: "To Search Together"]

[Text] "Steadily Implement the Joint Comprehensive Program for Scientific and Technological Progress of the CEMA Member Countries up to the Year 2000."

(From the Basic Directions of Economic and Social Development of the USSR for 1986-1990 and the Period up to the Year 2000).

Today, when the Socialist countries have embarked upon a policy to accelerate scientific and technological progress in every way, particularly relevant is the question: What benefit is society deriving from its investments in basic science? Of course, most often it is not easy to make specific prognoses about the possible practical benefit of one or another aspect of basic research. But the history of science indicates graphically that every success in theory necessarily leads to new practical achievements. This feature of basic research was noted clearly at the 27th CPSU Congress.

The ever increasing complexity and depth of modern scientific research requires joint efforts, not only by individual scientific institutions, and not only of different branches of industry, but also by specialists from different countries. At the same time, as the experience of the Socialist states indicates, such integration of efforts facilitates the subsequent attainment of practical benefits from the results of basic research. It is precisely this mechanism of interaction which has been made the foundation of the Comprehensive Program for Scientific and Technological Progress of the CEMA Countries up to the Year 2000.

The opportunities created here are indicated by the experience of the Joint Institute of Nuclear Research [OIYaI], in which specialists are working from the People's Republic of Bulgaria, Hungarian People's Republic, Socialist Republic of Vietnam, GDR, Korean People's Democratic Republic, Cuba, Mongolian People's Republic, Polish People's Republic, Socialist Republic of Romania, USSR and CSSR. It was created 30 years ago to unite the efforts of scientists in the Socialist states for joint research, aimed at expanding the use of

atomic energy for peaceful purposes. In fulfilling these tasks, the institute at the same time significantly influenced the development of basic nuclear physics, the training of cadre specialists and the raising of the scientific and technological capability of all the participating countries. During these years one additional, very important feature of the institute has been displayed; the multi-level nature of scientific inquiry.

The Dubna School for Theorists is credited with forming today's views about the structure of elementary particles and the atomic nucleus and creating the foundations for modern statistical mechanics, axiomatic quantum field theory and other subjects. Theoretical efforts carried out in Dubna led to the mathematical justification of such phenomena of practical importance as super fluidity and super conductivity. The views about light quarks as the basic components of matter were introduced by the Dubna theorists, and defined progress toward the realization of the fundamental idea of the unity of all the basic forces of nature: electromagnetic, strong, weak and gravitational. The search for such unity is essentially the search for the main, basic traits of the phenomena of the micro and macro world.

The broad front of basic research being carried out in the institute opens great opportunities for the mutual enrichment of related areas of science, and gives impetus to the development of new scientific directions. Relativistic nuclear physics; "cold" synthesis of transuranium elements; mesonic chemistry; ultracold neutron physics and other scientific avenues which originated at Dubna, as well as basic works by theorists, stimulated research in many scientific centers throughout the world, and elevated nuclear science to a new qualitative level.

In Dubna elements 102 through 109 of the Mendelyev Table were synthesized; new types of radioactive decay were discovered and a number of important laws of the interaction of heavy ions were revealed. The existence of unique pulsed beams of neutrons helped to lay the basis for modern methods of investigating the structure and dynamics of solids and fluids including complex biological objects. Works in the field of physics of weak interactions lead to the justification of the existence of two types of neutrinos: electron-type and ion-type. Dubna is associated with new ideas and methods for the acceleration of charged particles, in particular, the fundamentally new method of collective acceleration. Overall, half of all the discoveries in nuclear physics registered in the USSR came from Dubna.

The further growth of the scientific and technological capability of our state and the other Socialist countries is largely associated with intensification of scientific research. What does this mean for the scientists working at the Joint Institute?

First of all, the concentration of scientific efforts on the main avenues of the chosen spectrum of research and the search for ways of more effectively using accelerators, reactors, computers and physical apparatuses are underway. This means intensive improvement and modernization of the existing experimental arsenal and removing obsolete equipment from operation, in order to use effectively the labor and financial resources which are freed.

Modernization of the synchrophasotron -- one of the first accelerators in the institute, which every school child knows from textbooks -- can serve as a characteristic example. In the last decades more powerful proton accelerators appeared in the world, and the synchrophasotron lost its leadership to them.

Modernization of the synchrophasotron and the development of new original assemblies and systems gave a second youth to this accelerator -- it again became the world leader, having obtained a valuable new capability: the ability to accelerate relativistic nucleuses (i.e., nucleuses moving at a speed close to the speed of light).

But even this is still not everything. Redesign of the synchrophasotron is planned to make it a super conducting accelerator of nuclotron nucleuses, which will expand still further the capabilities of the equipment.

In general, the use of our own production base in creating new instruments is an important reserve for intensification of scientific research. In Dubna, many major assemblies and unique experimental instruments, electronic devices and information processing systems are made through our own efforts. The most vivid example is the construction of the U-400 Heavy Ion Accelerator Cyclotron entirely through the efforts of institute specialists. Currently it has the world's best characteristics among accelerators of its class.

Another important reserve which we have for intensification is the maximum use of international cooperation in carrying out research and creating experimental equipment. The international division of labor significantly speeds accomplishment of the scientific program. For example, the complex and far flung system of channels for transporting heavy ion beams derived from the U-400 accelerator was entirely manufactured in Romania. One of the most important parts of the new IBR-2 pulse reactor -- the electronic equipment for the reactor's control and protection system -- was developed and manufactured in the Polish People's Republic.

Important contributions to the creation of the "Neutrino Detector" large scale physical assembly, created by OIYaI along with the USSR Institute of High Energy Physics, were made by the Hungarian Central Physics Research Institute and the GDR Institute of High Energy Physics. A number of original physical assemblies for experiments on the IBR-2 were created in scientific centers in Hungary, Poland, the GDR and Czechoslovakia. Overall, the creation of virtually all the physical assemblies and accomplishment of theoretical and experimental research is carried out in close coordination with many scientific organizations in all the institute member countries. These number 400 scientific centers.

Ways to intensify research also derive through more effective use of scientific and technological links with scientific organizations. This is why we see one of our main tasks to be more precise planning of the division of labor of various centers in conducting research.

Priority avenues have been allotted in the Comprehensive Program for Scientific and Technological Progress of the CEMA countries. Analyzing our capabilities, we saw that the Dubna laboratories can contribute to their

accomplishment. Understandably, this refers most of all to atomic energy. Spectrometric information obtained at Dubna during the course of nuclear physics research is transmitted to the Center for Nuclear Data and is used in calculations of reactors and other nuclear facilities. Research of the phenomenon of nu-catalysis of reactions from the synthesis of hydrogen isotopes will make it possible in the future to make a conclusion about the possible use of this phenomenon to obtain nuclear energy.

But the special features of modern basic research, which necessitate not only the use of the latest achievement of technology, but also the creation of new materials, instruments and means of automation and technology, enable the Dubna scientists also to become direct participants in the development of other priority areas of the Comprehensive Program.

In the field of materials technology, this is the development at the institute of methods of neutron and gamma-activation analysis, with the use of different sources of radiation. The use of heavy ion beams makes it possible to carry out various experiments to study changes in the structure and physical characteristics of metals, alloys and minerals.

Systems for the automation of physics research, processing of experimental data, creation of many original electronics units, as well as mathematics support and general purpose programs for computers, which originated at the institute, are a contribution by the institute to solving two more tasks of the Comprehensive Program. The USSR Council of Ministers awarded its 1985 prize to a number of authors, including workers from our institute, for the development of KAMAK [branch of International Association for Cybernetics] based on International Standards, and the organization of production of an apparatus for scientific and scientific-technological research automation systems.

In the fields of bio-technology, biology and medicine, this contribution involved research in radiation therapy (the creation of a physics clinic complex) and the development of methods to obtain and prepare compounds of rare radionuclides for medical diagnostics. It also included the creation of nuclear filters for micro and ultra-filtration. It included research into the laws of the operation of magnetic fields and radiation on the cells of animals, vegetation, and micro organisms.

The CPSU Central Committee Political Report to the 27th Party Congress stated that it is necessary to carry out more energetically the shift of science to the needs of the economy. Scientists from the Socialist countries working in Dubna understand well and take into account this command of our time in planning their research. In the scientific program of the institute for 1986-1990, one-fifth of research efforts have an applied aspect.

Currently a new stage is beginning in the activity of the institute. A five-year plan has been approved and a long term program for the development of the institute up to the year 2000 is being worked out. They reflect the most important tasks set by the 27th CPSU Congress, the congresses of the Communist and workers parties of the other Socialist countries and the Basic Directions of the Comprehensive Program.

I can say with satisfaction that the activity of the collective at the Joint Institute, which is structured on Lenin's principles of international solidarity and equal cooperation among the fraternal countries of the Socialist community, has brought not only important scientific results. The atmosphere of scientific democracy and strong international ties at Dubna has become a force which contributes to confirming the high principles of the struggle for peace and social progress.

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CSO: 1814/168



## GENERAL

### OVCHINNIKOV INTERVIEWED ON 27TH CONGRESS IMPACT ON STATE PRIORITIES

Moscow IZVESTIYA in Russian 20 Apr 86 p 2

[Interview with Academician Yuriy Anatolyevich Ovchinnikov, vice president, USSR Academy of Sciences, by IZVESTIYA correspondent Kim Smirnov, under the rubric "20 April -- Soviet Science Day": "Discoveries -- For the Benefit of Man"]

[Text] [Question] Yuriy Anatolyevich! From the first days of Soviet government science in our country has been raised to the level of the highest state priorities and oriented toward solving the most important national problems. What new did the 27th CPSU Congress introduce into this fundamental position?

[Answer] I believe that for the first time the acceleration of scientific and technological progress was posed as a specific, urgent task for the country, both in the sphere of science, and that of production. A reference point was named: by the end of the century to reach the world standard in all the main aspects of scientific and technological progress. This is very difficult, but I am convinced, realistic.

[Question] What tasks does this reference point pose to scientists?

[Answer] It concerns their responsibility to the party and people for a qualitatively new level of research, in the first place basic research, which will make it possible to enrich the economy and all of our life with new ideas which will transform it in a revolutionary way. We also need further discoveries. We need precise criteria for assessing research work according to the highest ways of accounting. We have collectives which occupy leading positions in worldwide science. But there are also those which have long been floundering on the sidelines, but are quite willing to declare themselves to be "working at the world level." We manifest a false "humanism" toward this. And it is alien to true science and costly to the state. Our scientific soviets at all levels can demand this high accounting. Before this many of them must stop being clubs for interesting meetings.

Priority directions along which research will develop are the extracted and renewed sources of energy, and its new types -- atomic and thermonuclear. These involve problems of machinery reliability and automation and control in

machine building. They involve the mastery of space; the emergence of industrial production of technological lasers; computerization of the economy; and the formation and development of microelectronics, which was called the catalyzer of progress at the Party Congress. They include new materials; the creation of new varieties and strains, the fodder base and ensuring the stability of agricultural animals and vegetation against sickness, climatic caprice and other risk factors. Finally, it includes the comprehensive processing of raw materials and minerals. It is directly related to protection of the environment, which is of special importance to our country, which has so far preserved unique geographic areas of wildlife.

[Question] The Party Congress approved the creation of inter-departmental scientific and technological complexes (MNTK). The Biogen Complex (lead organization, Institute of Bioorganic Chemistry imeni M. M. Shemyakin), the purpose of which is, in part, to introduce the achievements of genetic and cellular engineering, is especially interesting to the readers. How was it organized?

[Answer] The task of Biogen is to manufacture the newest and latest generations of compounds for medicine and agriculture, based on biotechnological methods. They include, for example, insulin and interferon; human growth hormones; immunostimulators and anti-cancer compounds. On the agenda are hormones for cattle growth; cell cultures for vegetation of practical value and vaccines against illnesses to domestic farm animals: leucosis, brucellosis and foot-and-mouth disease.

Our complex is an academic one, and in its work take part scientists from Moscow, Novosibirsk, the Ukraine, Latvia and Bashkiriya; and such preeminent biological institutes of the USSR Academy of Sciences as the Institute of Bioorganic Chemistry; Institute of Biochemistry and Physiology of Microorganisms; Institute of Molecular Biology; Institute of the Physiology of Plants, and others; the Biolar NPO [Scientific Production Association] in Latvia and the biological instrument making SKB [Special Design Office] in Pushchino. But we are working in coordination with the Ministry of the Medical and Microbiological Industry and with other departments. Now, for example, Gosagroprom [State Committee for the Agricultural Industry], VASKHNIL [All-Union Academy of Agricultural Sciences imeni V. I. Lenin] and the USSR Academy of Sciences, with the participation of MNTK, is developing 12 biotechnological centers in the country -- strongpoints of genetic and cellular engineering.

[Question] Is the revolution which biotechnology promises for agriculture, including qualitative changes in the methods of obtaining breeding cattle, also being taken into account in the program of your MNTK?

[Answer] Yes. This year, along with VASKHNIL, we discussed all the scientific and organizational issues and agreed about how to overcome weak areas. And next work is beginning at agricultural stations and in the kolkhozes and sovkhozes. We must more effectively assist agriculture with this powerful science. Much is expected from scientists today. And they have something to offer. But in transitioning to practice it will be necessary to break up stagnation.

A paradox is taking place. The MNTK are declared from above to be instruments of acceleration. But their material support is so far created based on traditional, unhurried tempos and methods. The complex is ready, let us assume, to provide production in the middle of the 12th Five-Year Plan if it is provided with everything necessary. But output for it is being planned for 1995-2000. Why then create the MNTKs?

[Question] This is the case with respect to your complex?

[Answer] Unfortunately, it is also true of others. We are in a better situation. The tasks posed to the complexes are maximal: to provide output of the newest products important to the country in the shortest periods of time. But, you see, then their material and technological base must also be provided according to the latest, revolutionary principles. It is a fetish to try to create complexes by paragraphs of statutes about them, while leaving the base at its former level.

[Question] Some practical workers justify their distrust in biotechnology by pointing out that in agriculture there have already been many premature innovations, from which the land and its productivity suffered in the final analysis.

[Answer] But the revolution which biotechnology is bringing to agriculture is based on the solid traditions of Soviet science. It has been prepared by the work and the entire lives of the classics of Soviet genetics -- N. I. Vavilov, N. K. Koltsov, A. S. Serebrovskiy and other scientists of the outstanding school of science which in the 1920's and 1930's was world leader in genetics. Its concept was structured on giving first class genetic material to agriculture.

For example, how farsighted and even prophetic were the laws discovered by Vavilov of homologous series in heredity variability and his determination of world centers of origin of crops.

Today in research organizations throughout the planet there is a real boom going on. Everyone is attempting to create genetic funds of crops. They are embracing computers. Millions of dollars are paid to other countries for necessary biological material. We have such a fund, the largest in the world, which was created back in the 1930's through the efforts of Vavilov, and that heroic feat was preserved in the starvation blockade of Leningrad.

The scientific basis for soil conservation was worked out by V. V. Dokuchayev and D. N. Pryanishnikov. No, it is unsuitable for us to forget our heritage when speaking about traditions! It is people without historical memory, who are shameless and have no conscience, who spoiled our land with premature supposed innovations.

On the other hand, any revolution, the scientific and technological revolution as well, poses tasks which are unprecedented in history. When 10 years ago the first practical applications of genetic engineering began, the question arose as to where to acquire specialists. Like cosmonauts, they had to be

trained for the first time. And we began to train them ourselves. Now our institute is a major scientific training center. The faculty of physical and chemical biology of the Moscow Physical Technical Institute and appropriate departments of MGU [Moscow State University] and the Moscow Fine Chemical Technology Institute imeni M. V. Lomonosov are taking part in the work of Biogen. At the center lectures are given and practical activities are carried out using a good methodological base.

A nucleus of specialists has been created. But in the next few years the country will require many more than today. In connection with this, the need is arising unavoidably to circulate the knowledge and experience and create textbooks and training aids which crystallize the latest knowledge in biotechnology and genetic and cellular engineering. We are preparing such a textbook, the first in our country and, it seems, the world as well, and it will be published next year. I believe that this is a problem for all the MNTK.

[Question] Why does our practical medicine so slowly assimilate the achievements of basic science? Is there a lack of a reliable mechanism for introducing these achievements?

[Answer] Although progress is taking place, neither patients, nor doctors are satisfied with what is reaching individuals from the rich arsenal of science. Dozens of medicines have already been obtained which strengthen the protective powers of the organism and its immunity; compounds which regulate the vital activity within the organism itself -- the above mentioned interferon and insulin, for example. It remains necessary to organize production in the amounts required by polyclinics and hospitals. Unfortunately, this is not yet happening.

[Question] One can hear the justification that a long period of testing is necessary here.

[Answer] The guarantee of reliability and the testing system truly must be ideal. But we have been testing some medicines for 10-12 years and as a result are still not meeting world standards. And why is this? Yes, in the development, testing, and placing in use of new medicines and compounds, we do in fact lack an optimal mechanism for introduction.

[Question] And how can this path be accelerated?

[Answer] New approaches and the breakup of existing views are required. In our testing it is necessary to use the most modern methods, cellular cultures of laboratory animals of pure lines, etc., and based on extensive use of computers.

Changes in production have also long been pressing. Clumsy and unwieldy labyrinth enterprises, or perhaps more accurately, mastodons, are helpless here. Small, mobile experimental factories which can easily be restructured on the principle of flexible technologies, which are directed toward the introduction of the latest, priority compounds, will cope with task. In some leading biological and medical centers and institutes they already exist.

Also required is a more extensive spectrum of inquiry for new medicines, both in the laboratories and in nature. Already today many more compounds of natural origin can be included in research, and later also in practice -- from grasses and from products of the sea. These are the richest reserves of health.

[Question] According to many forecasts, in the immediate future biology should occupy the leading position in the constellation of sciences. We are already witnesses of how various sciences are more and more converging on the most complex object of nature -- man. Is it not time to coordinate their actions?

[Answer] Everything which science creates under conditions of Socialist society is called upon, in the final analysis, to serve mankind. But there are areas of knowledge which are directly associated with this, and this aspect deserves particular examination. For biologists the human organism is the highest form of living matter, its new quality and the crown of life. Man's higher nervous system, heredity apparatus and immunological mechanisms are extremely complex, and each new step in their understanding is acquired with difficulty. Medicine and medical science are oriented on concern for man and on protecting his health. They investigate the nature of various illnesses and ailments and ways of preventing and combating them. But the essence of man is social and, of course, he is at the center of attention of all the social sciences, most of all philosophy.

The world outlook of Soviet scientists here is clear and unified, but in order to study this problem more thoroughly, not lessen specific interest in mankind and better oppose the numerous false scientific concepts of Western ideologues, it is necessary for us to strengthen the ties among different sciences. I am sure that the just created scientific soviet of the USSR Academy of Sciences for the comprehensive study of man will facilitate this.

For science to reach mankind the strategic unity of philosophy, biology and medicine must be ensured most of all. It is necessary to set up research work, education and popularization of scientific achievements among the broad masses. It is necessary not merely to popularize these achievements. It is necessary to form the scientific world outlook of the people.

The modern world poses numerous complex questions to people. These include great tension in interactions with the environment, nuclear testing, conflicts and war. Therefore, we must continuously increase our attention toward the problem of man and make it truly problem number one in our science.

[Question] In conclusion I would like to ask what results may be expected from science by the beginning of the new century.

[Answer] Well, here I can dream, but based on reality and scientific intuition. If war is averted on earth and the forces of peace and progress prevail, and we are sure of this and are struggling toward this end, then the tasks of excluding unproductive manual labor from our lives; creating inexhaustible and cheap sources of energy; ringing the entire planet with a unified transport, communications and computer network; achieving practical

mastery of the ocean's depths and the heights of space, eliminating permanently the problem of harmful industrial wastes; understanding the causes of many still dangerous human illnesses and finding means of combating them seem fully realizable. I have no doubt that one of the main contributions will be made by scientists from the USSR and the countries of the Socialist community.

Soviet scientists are working in a peaceful field of endeavor and, therefore, completely support the peaceloving policy of our country and the proposals and actions of the Soviet leadership in the world arena, and angrily condemn aggressors and adventurists. They are toiling selflessly to implement the grand plans of the party, in the name of progress and peace.

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GENERAL

FROLOV INTERVIEWED ON LAGS IN INTRODUCTION OF INNOVATIONS

Moscow IZVESTIYA in Russian 17 Apr 86 p 2

[Interview with Academician K. V. Frolov, vice president, USSR Academy of Sciences, by IZVESTIYA correspondent Kim Smirnov, under the rubric "27th Congress of the CPSU: A Strategy for Growth": "Science, Machines and Man"]

[Text] In the USSR Academy of Sciences Mechanical Engineering Institute, in the exhibition hall dedicated to the 27th CPSU Congress, are ideas embodied in metal by which the machines of the new millenium are to work. And can it not be earlier? Essentially the entire exhibition is a direct reproach to industry. So many outstanding efforts brought, as we say, "by the hand" to the factory gates and -- remain outside the gates. How can we open up the path to new things?

[Question] Konstantin Vasilyevich! My first question to you is both as vice president of the academy and as the director of the Institute of Mechanical Engineering. It is possible, of course, to see only individual exceptions in the fact that for decades necessary innovations have not been introduced. But would it not be more useful to see also a common mechanism fr holding back progress, with which it is necessary to deal, and which must be overcome in order to ensure acceleration?

[Answer] I agree. That which you call holding back progress and which I would call moving forward with insufficient speed is caused by serious objective circumstances. They include weakness in the experimental base of scientific organizations; the disassociation between academic, branch and VUZ sectors of research work, especially in solving interdepartmental problems, which has taken shape over the years; and finally, a lack of effective economic incentives and levers, both of which require the introduction of innovation and which provide incentives for that introduction.

Take machine building. This is a field where already today the contours of the automated, computerized production of the 21st century are being drawn, and where the practicality of basic knowledge is particularly obvious.

And, although Soviet machinebuilders have something to be proud of, there are, however, so many products of our machine building industry which still do not



correspond to the best worldwide models, are obsolete, and which should have been removed from production long ago.

At the same time, there are still many innovations revolutionizing production which remain immobilized scientific capital. And this is truly not a matter of individual ideas, machines and technologies. The creation of reliable, economical and durable machinery must take place along a single, broad front. Progress here cannot be accelerated if the development of electronics and electrical engineering are not accelerated correspondingly and if highly efficient construction, friction and anti-friction materials are not produced in the necessary quantity and variety.

Today, in fulfillment of the decisions of the 27th CPSU Congress, the transition of science to the needs of the economy is beginning to be carried out more energetically. But here another aspect is also important. Industry must be more interested than it is today in introducing everything new. Often production itself is not prepared for this. If we desire to make a higher precision instrument, higher precision machine tools, metrological devices, etc. are needed. This is a whole chain. This means that it is necessary to reequip and reorganize production. And the enterprise does not have the funds for this. Or it is not planned. We do not plan to what quality to bring production, or to what material intensiveness, energy intensiveness, reliability or full operating time.

Of course this is not the situation everywhere. Here and there life itself forces this to be done. Take the aviation industry. If you do not love science here, you will fall. And from a great height. Although, of course, even in the aviation industry it is necessary to raise the requirement for aircraft reliability and flight safety.

A second index which is lacking today is accountability, not only for volume, but also for quality, for the demand which the production of the factory encountered.

A factory sent out, let us say, a turbine. It was sent out two days ahead of time. All of the bonuses for overfulfillment of the plan were received. But what a situation that no station has yet been built for the turbine! And why send it out, one might ask, if it will stand in the rain and snow for two more years plus two days?

The factory is not teaching its child, his "behavior." It raised him and that is all. As with bad parents, let others think about it further. This results in low reliability. This results in a situation in which factory repair has virtually not been organized for a number of structures in series production.

A computer center is required in which all product defects would be compiled. And as a result the manufacturer's account would be produced. This should include electric razors, internal combustion engines, shoes, clothing -- all products. If a factory failed to provide the required quality, let it receive a serious blow for this to the well-being of each employee, from director to

ordinary worker. Then the manufacturers will come to the scientists and will haunt the thresholds of exhibitions like ours.

[Question] Congress documents devoted serious attention to interdepartmental scientific and technological complexes (MNTK). You head one of them, "machinery reliability." What problems are arising in connection with this now, when the formation of MNTK is underway, for their organizers and for science and industry?

[Answer] Each complex has three "legs:" basic ideas; applied research; and the production of fundamentally new products, carried through as a minimum to the experimental batch of machinery, equipment, materials and instruments. From this also comes the organizational structure of the MNTK. It includes scientific, design and technological organizations, and experimental enterprises of various economic branches. It seems to me that our complex is one of the most practical, as we already have numerous developments which have reached the stage when they are to be placed into circulation.

One must not belittle any one of the three interconnected foundations on which the MNTK are based. Despite the role in revolutionizing production of new physical principles, phenomena and effects, they can play this role only when engineer solutions are found which enable them to be embodied "in metal."

On the other hand, in directing the MNTK to the end result, it is very important not to lose the basic and inquisitive nature of the work of the complexes, and not to make the chain utilitarian, a situation toward which, unfortunately, many branch NII [scientific research institutes] are sliding.

The idea of complexes -- the formation of which was influenced greatly by the experience of cooperation with industry of the Ukrainian, Belorussian, Lithuanian and other republic academies, the USSR Academy of Sciences and earlier experience in carrying out atomic and space projects -- this idea, in and of itself, is brilliant. But the path to its realization is difficult. And, of course, one must not think that the MNTK will solve everything. The complexes have been created only for primary, priority directions of investigative inquiry, which will make it possible to seize bridgeheads for the systematic acceleration of progress across the entire economic front.

Here everything is in our hands. Either we will organize matters as they should be organized, or we will confine ourselves to the glorification of ideas. This, unfortunately, is also a real danger which awaits any new project.

[Question] Are the measures provided for in the statute worked out by GKNT [USSR State Committee of the Council of Ministers on Science and Technology] adequate from this standpoint?

[Answer] Although the establishment of both our own and other complexes is finding serious and businesslike support, just the same it is very important not to discredit the idea from the very outset.

First of all it is necessary to set up a strong financial administration, so that the organizations which enter the complex obtain all necessary funds and materials, and in general can live, work and develop only through the leadership of the MNTK.

A most acute question is the priority supply of the complexes, and their complete support. If USSR Gosplan and USSR Gosstabilizatsiya do not provide materials and electronics, nothing will be gained. Nothing comes from nothing. It is necessary to write the complexes into the state plans on a separate line and to watch strictly to ensure that this line is substantial. Only in this case can we expect from the MNTK, not only their end product, but also their serious influence on the creation of an "especially favorable regime" for new innovations in the most varied areas of our life.

The first practical question which our MNTK must solve is the creation of modern testing, diagnostics and balancing equipment; testing units; gauges; instruments; laser assisted measuring methods; automated robots, etc. If this does not exist in science, quality will not exist in production. We are prepared to series produce many such innovations. You saw our exhibition. We can multiply it ten-fold.

[Question] You talked about the danger of being limited to the glorification of ideas. If only we don't drown the outstanding idea of the complexes in paperwork. There are also such "sober philosophers" who are prepared to applaud a new idea, but in doing so expect that "everything will settle down" and that they will return to the old, customary way of life.

[Answer] Nothing will settle down! And it will not return to the old way. And whoever thinks this and wants to live in the old way will inevitably be thrown out at a sharp turn onto the side of the road. This is also the significance of the 27th Party Congress, that acceleration is not only declared, but will also be regarded as of paramount importance in actual, everyday work. For us there is no other way.

Recently a number of important measures have been taken in the country against "paper creativity." And these measures must be uncompromising and carried out to the end. They must completely eliminate formalism and many-layered coordination, and prevent the overwhelming of scientific creativity in a paper wave of accountability according to numerous indices, and the replacement of scientific labor with uncharacteristic functions of economic activity.

[Question] At your exhibition the section on "man-machine" systems especially interested me. Does it not seem to you that when speaking of the technology of the 21st Century, it is necessary to think no less (if we take not words, but deeds) about the new generations of people who will create and control these machines, than about the new generations of machines themselves?

[Answer] This is a very important question. The combining of electronics with technology and with operating processes -- this is what machinebuilding will be tomorrow. The role of man in this system will become not only immeasurably more crucial. It will become qualitatively different.

The new, complex equipment is expensive to the state. At times it requires intricate handling. And in a number of economic branches it is being operated barbarously. One designer complained to me: "We can propose the most interesting solutions, but they also require the highest level of operation. It is necessary to create equipment which is calculated for an individual who is absolutely indifferent, and who thinks that if he breaks one machine they will provide another."

Yes, this problem exists. Today we are putting ever more sensitive control and monitoring devices in machinery. This requires a new attitude toward the equipment and a new type of individual interacting with it. The degree of civic responsibility and level of economic knowledge of each individual must correspond both to the spirit and the letter of the time. This, by the way, is important not only for engineers, technicians and workers, but also for the most highly skilled specialist. It is extremely necessary, for example, that every candidate's and doctoral dissertation which sets forth new technological ideas contain a section on technical and economic analysis and forecasting. The author himself will only grow through this approach and will propose responsible and economically justified ways of introducing his research efforts.

Man must be prepared for the new equipment not only professionally, but also physiologically and psychologically. We find ourselves -- I wish to emphasize this -- on the boundary of the automated 21st Century and of automated machinebuilding production. And it is precisely here that new and progressive ideas can be introduced most quickly. But man must not lag behind!

Reform of higher education is overdue, very overdue. It is not right that for 15 years we have been teaching young people primarily how to operate machinery. It is not right to turn out mediocre engineers, who are not prepared to work under conditions of sharp acceleration both in science and industry. It is not right to train them on antiquated equipment. Later on it will be necessary to retrain them just the same.

They must be raised in a working environment and one of research and inquiry, directed at the end result. It will be well justified, in connection with this, to include VUZes within some MNTK. This will enable the student to take part in the work of scientific collectives from his third year on, to form traits of a research engineer and to be oriented toward solving urgent problems of science and economics.

In general, research creativity is becoming one of the characteristic traits of contemporary youth and an important way of training the scientific workers and specialists of the new generation. And it is time to place this on a systematic, state foundation. The Academy of Sciences supports the All-Union Komsomol Central Committee proposal: to create a single system in the country for the scientific and technological creativity of young people. However, this system must be built not only on enthusiasm, but also on the most up-to-date knowledge.

Here I again refer to the MNTK. They can combine scientific efforts and create modern training courses (many sections on the technical sciences are

very outmoded) and good training aids. It is necessary that every engineer, student and worker-rationalizer have in hand a book on the latest ideas and methods, accessible in content and form, without complex Aesopian language. In our concern about distributing such ideas in materials and "in metal," it is also necessary to distribute them in minds. This is why the MNTK must also be focal points for the restructuring of higher education and for training and retraining specialists working with the new equipment; schools of advanced scientific and technological experience; and touchstones for the work of the USSR Academy of Sciences under the new conditions.

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